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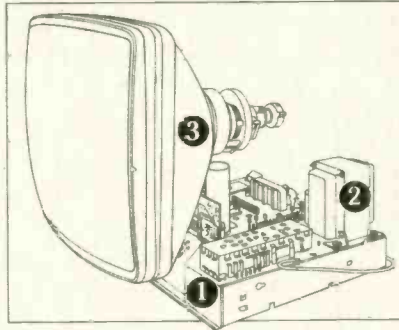


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Sometimes a crystal ball, such as the one shown on this month's cover, seems about as useful a tool as any in determining the color-TV set circuitry that will be encountered in the future to sell and/or service. Information concerning what we have learned about models available for 1974 is included in the article beginning on page 35.

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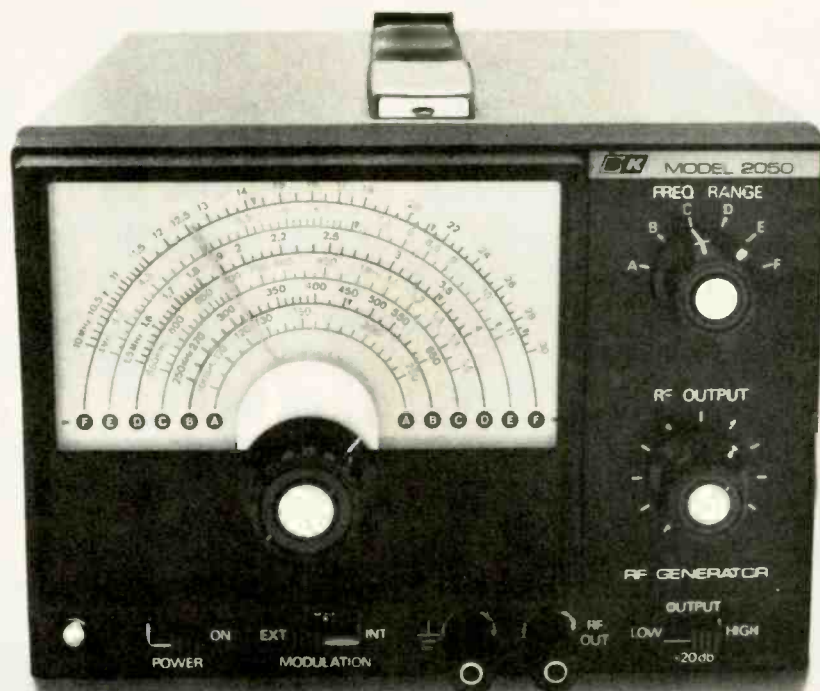
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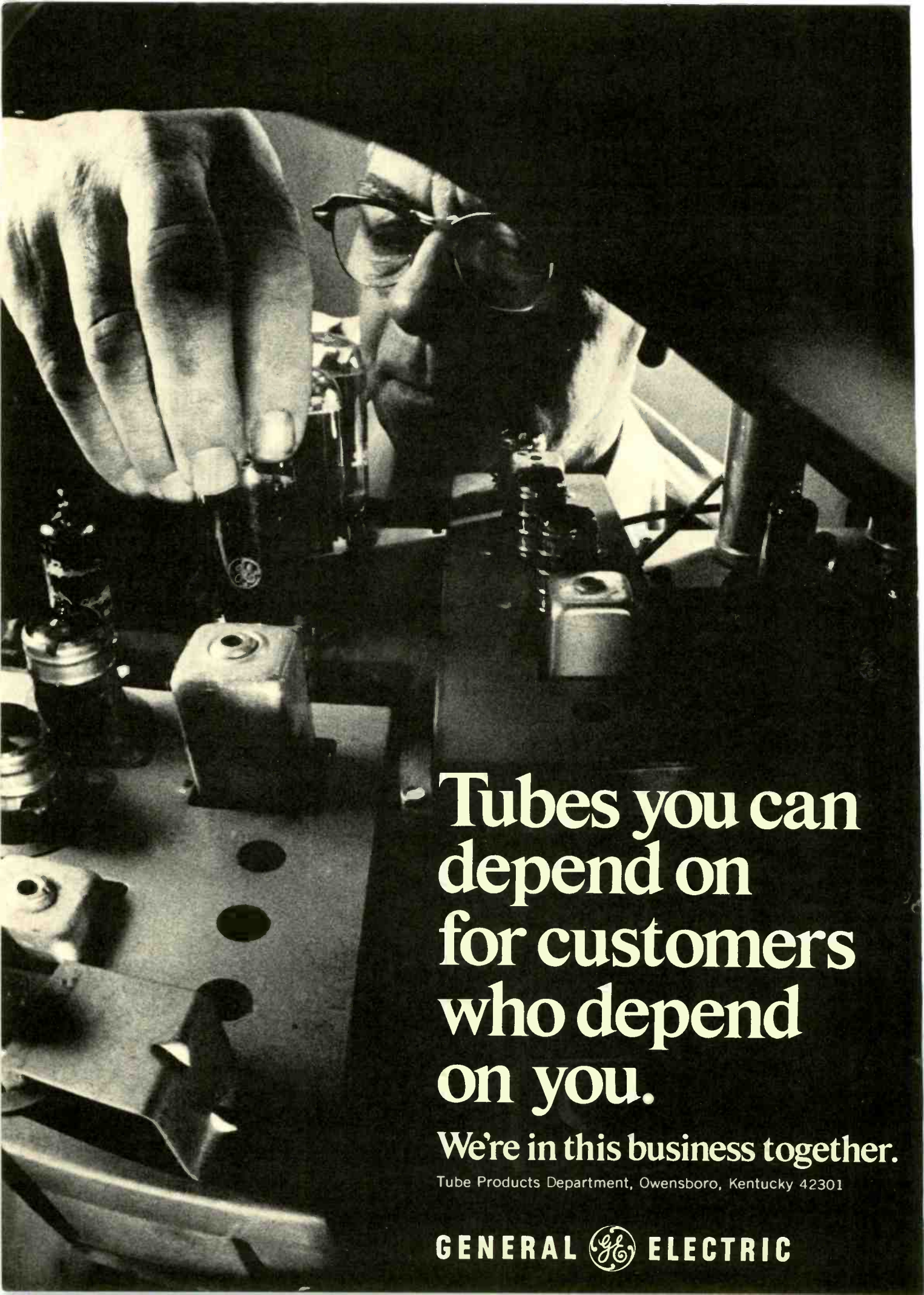
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## Fiddle While Rome Burns



Occasionally we receive a letter from one of our readers that concerns a subject of such great importance that it merits much more than a sentence or two of editorial comment in our Letters to the

Editor Column. Such is the case with the letter from Thomas Davenport, printed on page 9 of this month's issue, which is concerned with the growing trend toward the modularization of color-TV sets.

As you all know, modular design really isn't anything new. Back during World War II, the military found that the quick servicing of its communications equipment in the battle field—where there was little access to either test equipment or qualified electronic technicians—required the use of modular systems. At that time modular construction was considered a necessary expense which under normal conditions would have been rather extravagant.

Although the principle of modular design was well known by the end of World War II, and there were then a lot of "qualified" electronic technicians returning to civilian life that knew little more than modular servicing, it was not yet considered practical for civilian use.

There were several reasons why modular construction was not then generally considered acceptable. Except for those containing the then recently improved solid-state diode (one with a factory implanted "cats whisker"), tuned quartz crystals or those huge selenium rectifier plates, none of the circuitry contained solid-state components. Transistors, FETs and integrated circuits hadn't been invented yet. Thus the only active elements in those circuits were electron tubes. Due to their price, relatively large size, relatively high power requirements and heat dissipation, it simply wasn't practical to include too many tubes in a consumer electronic product. A five-tube radio, with possibly one tube serving a dual function of both RF amplification and RF rectification, was considered a good, large radio. (Who

today would purchase a five transistor radio having equal gain and hold it in such high respect. Today it must not only include transistors but integrated circuits—performing functions that would have once required the use of several dozen electron tubes.)

In those days, if any feedback circuits were used, it was for positive feedback, which offered increased gain with some loss of circuit stabilization. Today we use all sorts of negative feedback circuitry—having all the dynamic components necessary for as much gain as wanted—the negative feedback providing increased stabilization and automatic circuit functions.

Unlike the modules of World War II, which contained stacked boards of hand-wired circuits, printed-circuits are now used—they having at last become the more reliable form of wiring. This too has permitted the economical design of more complex circuitry.

When your editor first began servicing radio, it was a relatively simple job. Most often the problem was a defective electron tube. If not that, then a bad electrolytic capacitor. Next likely on the list of suspects was an open coupling capacitor. Third was either the power transformer, filament ballast tube, or filament resistance lead in the power cord. This latter group of components represented the only ones—except for possibly the IF transformers—for which there was never any real parts availability problem.

Yes, those were the days when it was rather simple to get into radio servicing. When so little training was required that everyone was getting into the act—and you were lucky if you made \$3.00 per job!

B/W-TV started out nearly the same way. All the sets had hand-wired circuit boards, tubes that at most performed two functions each, extremely limited use of negative-feedback circuits for automatic control, and a tremendous thirst for power—even for providing a small picture. And weight? Why one person alone could hardly lift a 12-in. TV set!

But the world has changed—as you will note in this month's preview of new color-TV sets for 1974, beginning on page 35. Almost every TV-set manufacturer is now switching to the

production of TV sets that contain but one tube—the picture tube. And we shall see even that being replaced with solid-state components in the next few years—yes even in color-TV sets. Virtually all color-TV sets now on the market make use of one or more integrated circuits, each containing the equivalent of a dozen or more transistors that perform what were once considered economically unfeasible circuit functions.

We are living in a time when the public expects the convenience of automatic circuit functions—at a low cost—that once were considered too expensive to design, let alone sell to the public. And they must be repaired.

Automated technology makes the modular approach—once considered far too expensive for civilian use—a practical matter—for the manufacturer and the consumer. If replacement modules are at hand, the consumer can have his color-TV set fixed much faster than a qualified electronic technician can trace the particular fault in the defective module. Some consumers are more interested in a quick good repair than they are in an economical good repair.

Unfortunately, as stated so well by Mr. Davenport, as circuitry continues to be developed at a rapid rate, there becomes a greater number of modules that must be stocked for rapid servicing. Can a small shop afford to invest in all these modules, let alone afford even the space to store them? And what does one do with a large inventory of modules that eventually become obsolete? One can occasionally substitute universal components as replacement parts, but there aren't universal modules! Is there an answer???

Despite all these problems, your editor personally favors the current development of modularized circuitry and considers it a good trend. . . an alternative to otherwise immediate disaster as our technology jumps ahead of the technical skills of many electronic technicians. Comments concerning his personal experience and attitude concerning such techniques were spelled out in his editorial, "Why Modular TV Circuits?" printed on page 23 of the January 1972 issue. However, let's face it, your editor did not invent the modular

*continued on page 8*



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## EDITORIAL ...

*continued from page 7*

concept and his personal attitude will neither help or hinder the current trend in that direction. Like it or not, modularization has come to stay!

Now that it is here, what do we do about it?

Let's face it—no single shop can maintain an adequate inventory of all modules required for servicing all makes and models of modular color-TV sets. If one is to make use of the modular exchange approach, then it becomes necessary to restrict one's business to the two or three brands that have distributors best prepared to supplement your inventory of modules on short notice. (On that basis, direct manufacturer promotion to the electronic technician and service dealer will in the future have far greater impact on a product's success or failure than will consumer promotions or consumer advertising. If a product is relatively expensive—as most color-TV sets are—and no one will fix it, what knowing customer is going to buy it?) Yes, it hurts to have to turn business away, but few shops have enough business to keep these modules in active stock turnover. And any shop keeping modules unused on the shelf for several months is losing money on its investment.

Although some manufacturers like to promote the concept that a module is a throw-away item, others promote the fact that modules can be serviced—in fact more easily than the old-style TV chassis, since much of the work can now be done at a more convenient location outside the chassis. The decision concerning whether or not to service these modules should be your decision, and it should be based on such questions as whether or not your time for servicing the module is worth more than the cost of a new module, and the value of defective components to be replaced on the module.

Some enterprising electronic technicians are considering the possibility of starting shops on a regional basis that will concentrate solely on the wholesale repair of defective modules (like some of the tuner-service companies in existence today). With such service available to you (some TV-set manufacturers currently provide this service), you would be able to remove a defective module and replace it with a rebuilt one—just like

some garages may replace the defective alternator, starter or voltage regulator in your car with a rebuilt one. (However, be on the look out for defective rebuilds in electronic modules just as you must those many defective rebuilt auto parts.) Such service techniques are legal—provided the customer is given an opportunity to decide in advance whether he wants his TV set fixed with new or used parts, and the use of rebuilt modules is clearly stated on the customer invoice. Otherwise, at least in an increasing number of states, you may find yourself accused of customer fraud as a result of servicing with used parts.

There will never be a day when everything that there is to invent has been invented—long before then the Sun will have died of old age and the world will have come to an end. On that basis, we will never see a time when manufacturers stop changing and improving the consumer electronic products that we sell or service. Only a lack of available capital, a lack of consumer interest, or stagnation from government control will bring a stop to such future product development. Unless stagnation does occur, we will find ourselves continually faced with more sophisticated circuitry and new modular concepts. Thus there must be even greater selectivity in what we are prepared to service, and more technical training will be required for the job. Those shops unable to cope with the situation will simply fold . . . these are the cold, hard facts. The world does not owe us a living, and if we can't keep up, we are forced out.

Your editor, your fellow electronic technicians and service dealers, your trade associations, etc., will do all that is possible to keep you up to date . . . but none of us can turn back the clock!

*Phillip Dahlen, C&E*

Comments from our readers are always welcome. Address your letters to:

Phillip Dahlen, Editor  
Electronic Technician/Dealer  
1 East First Street  
Duluth, Minnesota 55802



## LETTERS

Reader comments concerning past feature articles, Editor's Memos, previous reader responses or other subjects of interest to the industry.

### What's to Be Done About Modular Circuitry?

There is a subject of the most profound and timely topic that I wish you to inform us about. With all consumer electronics (color TV) going to panel-type construction, what potential does the average one- or two-man shop have to stay alive in this business?

For example, yesterday I went into the attic and resurrected an old caddy completely filling it with boxes containing 1974 Magnavox panels and modules. In my trunk is a large caddy containing only Motorola panels. I now have five caddies in my 1972 Dodge Van.

Must I contemplate driving a Greyhound Bus full of caddies by 1974—five years down the pike? And the customers wonder why we charge for a service call! I would estimate that it will soon cost \$15.00 to set the brakes in front of a home with such a medicine show.

Your magazine is terrific, but please stop fiddling while Rome burns and give us an in-depth report on this growing cancer.

THOMAS H. DAVENPORT

*There is still a great future for any one- or two-man shop—provided it begins to specialize, restricting future work to but a couple of name brands for reduced inventory; and provided the electronic technicians employed there keep up with current technological developments. Please note the additional comments in this month's editorial. Ed.*

### Those Who Won't Take Sides

The curious thing about those who enjoy personal opinions by the editor of this magazine and who stridently disdain "taking sides" with a passionate revivalistic dedication to the *laissez faire* principle in matters purely electronic, is that they virtually out Dahlen, Mr. Dahlen! But the pure and unadorned truth is that it reflects an quintessence of hypocrisy and smacks of liberalism so insipid as to defy taste analysis. In point of fact, the electronic servicing industry is staffed by real flesh and blood people VERY MUCH touched by the issues these critics of Mr. Dahlen's editorial policy so dislike. A case study is the all too concrete dilemma depicted by the edi-

tor under the caption "What would you do?" on page 10 of the April issue of this magazine. The critics cannonading the NEA, NATESA, CET's et al are living in an Alice-in-Wonderland world couched in a phony gravity free idealism quite alien to the type of existence characterizing the sixteentons-a-day known to technicians at large who stand face to face with gut decisions—gut decisions demanding immediate judgement that cannot be deferred by idealistic noodlings. Such things ARE a part of this magazine. In fact, this is the juncture where a position must be made, a 'side taken', if you will, based on expediency and rational merit.

In all candor, how do you defer or temporize on an issue as germane as extended warranties or in-board warranties which quite literally tells the service dealer WHAT to charge and the CONDITIONS under which said transactions take place? Was Mr. Dahlen, as editor of this magazine, high on LSD when he boldly outlined for the readers what must clearly be the most overlooked technological reality since the advent of TV itself—namely the staggering potential of satellites propagating TV signals vis-a-vis' CATV/VHF broadcasting as conceived to date? I must confess my guilt and my surprise relative to the paucity of letters from technicians on the subject whose cognitive powers confirm the technological feasibility of such a system yet seem strangely mesmerized by the incredible status quo that hucksters TV viewers into a fatalistic zombie-like two step to the same old hackneyed drum beat deifying CATV as THE vehicle of the future! I can only commend Mr. Dahlen both for his sagacity and his risking to say it—and I'll go on record right here and now and say that the next five to eight years will prove him dead right and his critics dead wrong relative to satellite TV vis-a-vis' CATV. May I also say I elicit all the information the editor can dredge up on satellite propagated TV, both theoretical and functional; it is thrilling to contemplate the possibilities of wrist-watch TV, vehicular TV—in short, TV anywhere in this country with good quality.

I submit the following: if the kind of pride and rational concern inspiring technicians and shop owners to seek out excellence in their chosen field of endeavor, to wit, those principles which are the warp and woof of NEA, NATESA, as viable and relevant organs of our industry (where other alternatives do not exist which can address industrial/consumer interests) that is, if these things cannot be, the industry will inevitably suffer

atrophy and plunge into a tight orbit created by the manufacturer/consumeristic combine; this gentleman is 1984 replete with the very thing our liberal (?) friends want! No digressions, no CET's, no NEA and no NATESA; just one big beautiful monolith! But who in his right mind wants it if he expects to be his own man? Like the song goes: "—where can I go to when nobody needs me?" I submit that a robot could do just as well—all judgements are programmed. Beautiful!!

VINCENT L. IRVAN, CET

### Author Replies to Reader Comment

I just received the August issue of ET/D and read the letter from Mr. Frederick P. Hall, Jr., critical of the Tuner Cover Booby Trap piece. I 'ave received many compliments here concerning the article and hope that you have too.

While it is true that there are a few of these tuners with beige strips, I take issue with him regarding the contacts adjustability. Enclosed is an SK tuner maintenance booklet from the factory—which should know—showing adjustability of the contacts.

BOB COOK, CET

### Offers Comments Concerning June Editorial on Servicing

In regard to your June editorial: I service all products. If they are difficult to service because of design, I charge accordingly. I charge for all time—including phone calls and letters—when obtaining parts that I do not normally stock. Most of my charges are based on the time spent to make the repair, not on whether it is a TV set or radio.

I do service at a lower rate items that I have sold. My rates are posted where everyone can see them.

I find it very hard to sell only the best products, as most companies do not do well on all items. I sell one brand of TV set that I think is excellent. I do not sell this same company's stereo because I do not care for the record changers they use. I would sell two other brands of TV sets if they were handled by better distributors.

I am not very interested in the sale of electronic equipment since the profit margin is poor. Most discount houses sell below our cost. I was about to buy radios at \$12.50 each from a distributor and then found the same radio advertised by a discounter at \$11.80. I often see one brand of TV

*continued on page 10*

# UNTIL RECENTLY, THERE WERE OVER 22,500 TRANSISTOR PART NUMBERS TO WORRY ABOUT IN THE SERVICE BUSINESS.

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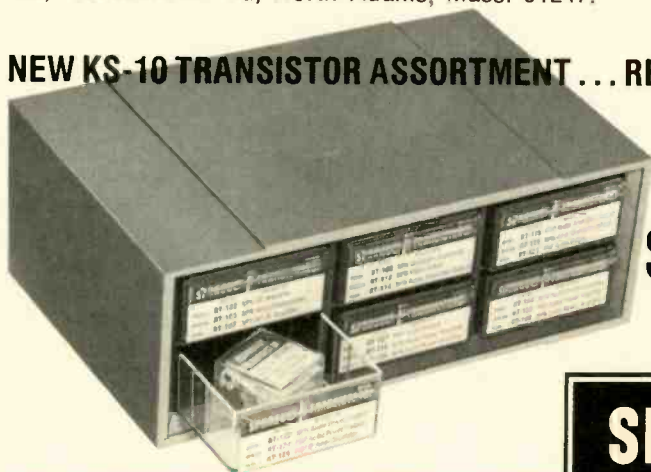
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**And here's more good news!** To help you keep the most-frequently-used transistors handy in your shop, we've got a new KS-10 Transistor Assortment. The Keen 18 . . . 10 small-signal transistors and 8 power transistors . . . give you a working inventory that replaces thousands of the most popular domestic and foreign O.E.M. part numbers. They come in an attractive, blue, durable plastic cabinet . . . you pay for transistors *only* . . . cabinet is yours at no additional cost!

See the KS-10 with a special introductory price at your distributor's. While you're there, pick up a free copy of the 48-page Sprague K-500 Semiconductor Replacement Manual. Or . . . write to Sprague Products Co., 65 Marshall St., North Adams, Mass. 01247.

**NEW KS-10 TRANSISTOR ASSORTMENT . . . REGULARLY \$34.11**



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introductory  
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## LETTERS . . .

*continued from page 9*

set advertised below my cost.

I find it more profitable to "service junk." The discounters can't offer discount service.

I notice that most modern TV sets have the same parts in them that have been causing trouble for 25 years: electrolytic capacitors, diodes, open capacitors, leaky capacitors, 47K resistors that change to 200K, dirty tuners, shorted yokes, etc. I am still trying to keep up with the "indestructible" transistor that will never wear out. We have picture tubes that lose their emission in a year or two.

As for customers fixing their own TV sets by changing panels—let them try. First they will have to decide which panel, then they will have to find a new panel. A few 24kv shots in the arm will discourage them. I service panel sets by changing defective parts. If the day comes when my skills are no longer needed, I will do something else for a living. The fellow who drives the local beer truck makes \$120.00 take home pay every week. How many TV servicemen make the same for a 40-hour week?

As for working on sets that will cause you to come up with a loss: Leave them alone and let your competitors lose money instead. Go fishing instead of working on losers. If you can't make a dollar, why bother.

DANIEL HILL

## What Future Salary Might One Expect?

I have been watching the pay earnings of service technicians in the State of Michigan, mainly Detroit and its suburbs. It has varied so greatly that it has confused me as to what a good technician should be receiving. If at all possible, could you send me a scale or chart of pay earnings for an average year showing pay according to different qualifications such as: bench man, road, antennas, stereo, etc. If a man did all four, would earnings be higher?

Suppose a man worked 48 hours a week doing four calls a day, installing two rotor antennas a day. If this man received \$4.50 per hour plus Blue Cross/Blue Shield, with no other benefits besides paid holidays, is this man below or average?

What I would like to learn is whether there is a promising future with good pay or an average job in which men could not be able to go to a high paying level. My future and



what I plan to do relies on this a lot, with the economy going as it is.

(We decided to withhold name)

The following is the reply that we sent him:

Salaries earned by electronic technicians vary a great deal between shops and towns. Some electronic technicians are lucky if they make \$4500, while we know of others making close to \$12,000. Some shops handle the matter by paying a flat rate basis for work performed, rather than hours worked.

If anyone has taken a survey or can supply us with additional information, please feel free to write us. Ed.

### Suggests New Product To Eliminate Batteries

My idea for a consumer electronic product would be a small radio with a built-in hand-operated generator—something like the pilot's automatic distress signaling device of World War II. The "hourglass" radio I believe it was called, with which the downed pilot sat and turned a crank and it sent out SOS calls and his approximate location at regular intervals.

My idea would be for a device with which you would sit and turn a crank and get the latest news, sports and weather if you wished, using your own muscles instead of short-lasting rather expensive batteries. It would also save on the materials batteries are made of.

JACK IMMELL

### Two Letters in June Issue Contain Some Important Facts

Two letters in the June 1973 issue prompt me to express two very (and I must stress very) important facts.

One, as stated, that the CET Program "could" lead to a "closed shop" condition or/and could lead to a union "take over" or even as a union could result in "Mob Type" control interested only in membership dues and industry controls. This cannot be denied or overlooked because this is most evident today in our society.

The "effort" of the CET is basically a wonderful program. Employers "should" have some degree of choice in selecting employees. This is an aid.

Another alternative would be for a sort of "guide-line" questionnaire provided to employers to let them present these to prospective employees. [This sounds a lot like the "NATESA Plan to Create Confidence" described on page 50 of our December 1972 issue. Ed.] It may be a little more time consuming but would remove the employer

from the "political hassle" and "union squeezeout" that is now in process. I am about to publish a book on this and its eroding effect on our society.

The other letter concerned the technician that was having difficulty with the electronic organ dealer. I say to him and all other technicians—even if it should come to the critical point of having to leave town on an empty stomach and to hit the road with only his VOM and his present "schooling"—it would not only improve his personal condition and mental attitude and really be a moment of truth for

himself—it would also be another "shot heard round the earth" for FREE ENTERPRISE!

I am semi-retired now, but all my life I have totally resisted joining unions and have quit many jobs when it was suggested to me that I join.

In conclusion I must say to all the "young techs" whenever the time should come in your life's work that you think your existence depends on your present job only—"then cut your throat!" You will be doing all the rest of society a service. Let's keep it free in all ways!

H. JOHNSON

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LBO-502 — 5"  
Solid State  
Triggered Scope

3 graded scale readings — 1, 2.5, 5  
Push-buttons, lab-grade quality.  
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1 $\mu$ s/cm (5X mag. 0.2 $\mu$ s/cm) to  
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 $\pm 2\%$  at 1KHz audio signal accuracy;  $\pm 2\%$  at  
19KHz pilot sig freq. accuracy. 0.3Vrms output. \$229.95



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Offers accurate, simultane-  
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on tape recorders and  
other units. Has separate  
meters for measuring  
each function.  
Accuracy is  $\pm 5\%$  of full scale  
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Compact, rugged, for bench or  
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TEST INSTRUMENTS

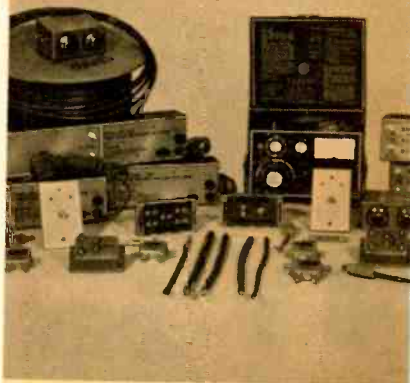
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It adds up to one of the most complete lines of MATV products on the market. Best of all, they're priced to sell—priced for you to make a profit.

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## READERS' AID

Space contributed to help serve the personal needs of you, our readers.

### Part Swap

I have many new repair parts for transistor radios which I received directly from the factories in Japan. I would like to trade them for domestic parts, mainly cassette tapes.

H. E. SPIEKER, JR.

2320 Hillcrest Ave.  
Pennsauken, N.J. 08110

### Wanted

I would like to obtain a power transformer for a Victor Radio, Model R-32.

BILL HAMMOND

Niobrara TV and Radio  
P.O. Box 1033  
Lusk, Wyo. 82225

I would like to obtain an operator's manual for a DuMont Cathode Ray Oscillograph (scope) Type 274. The instrument was manufactured by Allen B. DuMont Laboratories, Inc., Passaic, N.J., and was discontinued about 20 years ago.

WALTER F. BROWN

619½ N. Riverside Blvd.  
Goshen, Ind. 46526

I need two tubes for an old Philco radio, numbers XXD and 35A5. I also have a number of older radio tubes. Please write for list.

PAUL COURNOYER

Leisureville, Bldg. 26, Apt. 3  
Watervliet, N.Y. 12189

### For Sale

Riders Radio Trouble Shooters manuals, Volume 8 to 21 and Riders TV manuals, 2 to 26. Please make offer.

TROCH TELEVISION

290 Main St.  
Spotswood, N.J. 08884

I have a Heath Model IG57A Sweep Adder Generator factory wired and tested for sale. It includes all leads, IF Link Detector Probe and instructions.

C. W. HUME, CET

108 Hillcrest Circle  
Greenville, S.C. 29609

I have Sams Photofacts No. 1 through No. 200 for sale. Best offer.  
G. SWISKA

74 Keeley St.  
Fall River, Mass. 02723

### Schematic Needed

We need a schematic and instruction manual for an FM Modulation Monitor Model 257, manufactured by New London Inst. Co.

ALSYNCO

171 So. Main St.  
Natick, Mass. 01760

I would like to obtain a schematic for a Hickok Scope, Serial No. 25511914.

RICHARD RINALD

69 S. Montgomery St.  
Valley Stream, L.I., N.Y. 11580

### Schematic Wanted

I am in need of service information for a Bendix VHF Transceiver, Model IHOIC, and a surplus VHF Transceiver, Model MRT-G.

JULIO FONSECA, CET

2400 La Guard Dr.  
Hampton, Va. 23661

I would like to obtain a schematic for a GR15 Pentron Tape Recorder.

M. BOLNICK

621 E. 82nd St.  
Brooklyn, N.Y. 11236

I would like to obtain a schematic and parts list for a Lantz Model TV 7G, a B/W 7-in. portable TV set.

MICHAEL W. MCDANIEL

1286 Cortez, Apt. 3  
Sunnyvale, Calif. 94086

### Business for Sale

I have retired from the TV service business and would like to sell the shop, part stock and equipment. Please write for details.

SULO E. RAISANEN

203 Morgan Ave. N.  
Minneapolis, Minn. 55405

Having been in the service business since 1937 and am now retiring, I have for sale my Radio-TV-Stereo Sales and Service business which is located in the heart of the bluegrass in Kentucky with a city population of 10,000. Na-



tionally known radio, TV and stereo sales including service parts, tools, equipment, fixtures and 1970 Ford van. Please write for details.

JERRY JACKSON

924 Main St.  
Paris, Ky. 40361

I am retiring and would like to sell my TV and small appliance repair service. I will sell with or without building. Please write for details.

GEORGE E. BEAL, SR.

P.O. Box 1712  
Glendale, Ariz. 85311

Because of failing health, I must sell my TV Sales & Service business in Clearwater, Fla. This is a sacrifice for quick sale. Good location, TV repair shop in this same location for 25 years. More than the usual amount of modern test equipment, etc. Please write for details.

WILLIAM D. WAPLES

201 Belleair Oaks  
Largo, Fla. 33540

Because I am retiring, I wish to sell my TV Sales and Service business in north-central Wisconsin. It is a one- or two-man shop which includes stock, equipment, truck, and low-rent building. We have had 11 years of business in this location.

VAL FRANZEN

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# A LITTLE KNOWLEDGE IS A PROFITABLE THING.

(LIKE \$50 MORE A WEEK.)



Take our Super Frost Aid, for instance. The more you know about it, the more money it makes for you. You probably know it's the best way to find tricky intermittents. Just let the set cook, and when trouble shows up, spray the suspected circuit or stage component-by-component (it's easy with the free spray extender), until the trouble disappears. That's all there is to it—and there's no liquid residue!

But that's not all there is to Super Frost Aid. Not by a long shot.

When you suspect a cracked PC-board, there's no need to go over it with a magnifying glass. Spray Super Frost Aid on the board, and look for gaps on the conductors. It's easy. Fast. And a great way to make money on "tough dog" problems.

More? More! When you're soldering, Super Frost Aid is the easiest, fastest heat sink around. Spray on semiconductors and other delicate parts before soldering. Spray after soldering to make parts easy to handle. Also helps prevent burnout of transformers and other parts from abnormal conditions, by cooling them off quickly. Minimizes problems caused by shorts and other failures.

Super Frost Aid has many other general uses. Use it to cool and "shrink" the inner of two tight-fitting parts, to join or separate them.

Use it as an emergency fire extinguisher. Or as first-aid on burns. It's also handy for removing chewing gum and other adhesive materials—cold reduces adhesion, makes separation easier.

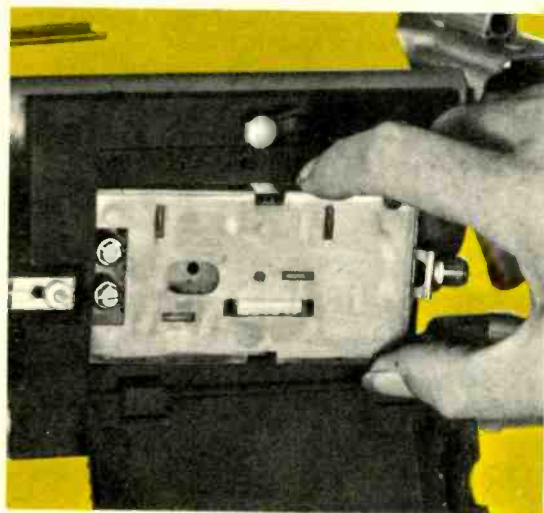
There are dozens of other ways Super Frost Aid—and our other chemical problem-solvers—can make life easier (and more profitable) for you. See them at your distributor's, or write for our brochure.



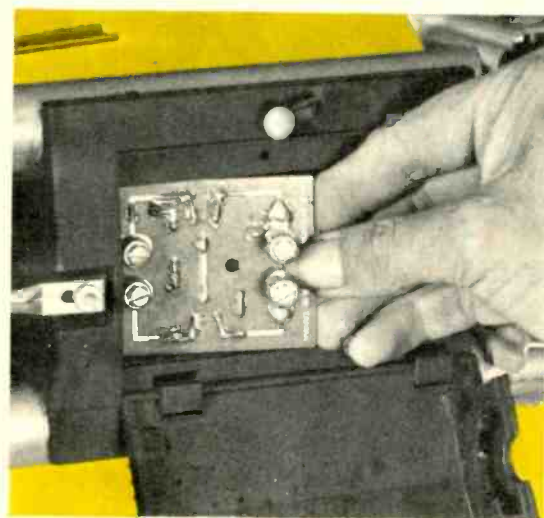
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Our business is improving yours.

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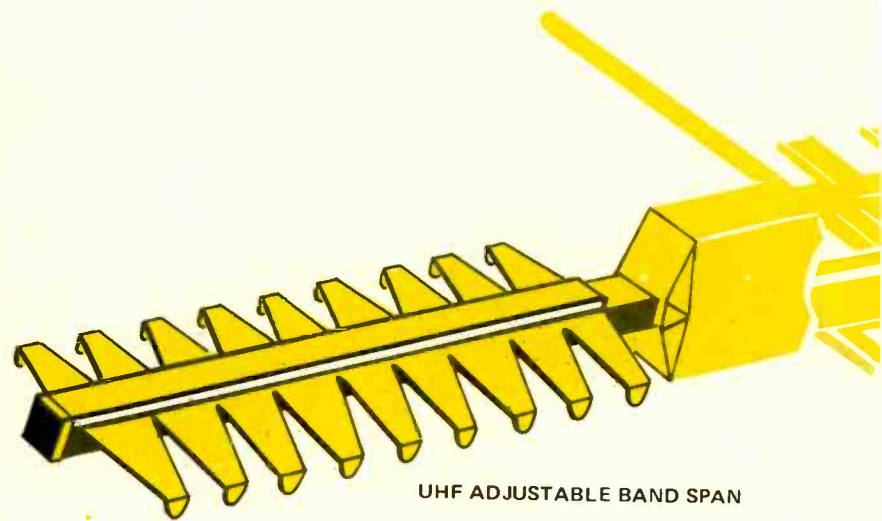
# One easy solution to five difficult reception problems



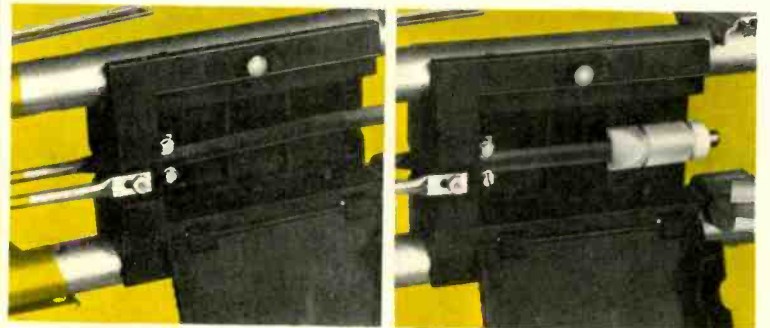
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UHF ADJUSTABLE BAND SPAN



MOUNT 300 or 75 OHM



# It's the Channel Master Quantum System...

the total system that's engineered from stem to stern to handle the problems that make peak reception more difficult each day. The Quantum Antenna and accessories provide the one-step solution to TV and FM reception problems such as:

**1. NOISE POLLUTION:** The electromagnetic noise and interference from power lines, ignition switches, electrical appliances, co, and adjacent channel interaction and hospital equipment. The Quantum Antenna cuts through the noise with the highest front to back ratios and directivity yet engineered into antennas, to reach desired channels with a new standard of clarity and sharpness!

**2. WEAK SIGNALS:** The Quantum's optional amplifier modules provide up to a 15dB boost for color and black and white reception in fringe areas! The solid state modules provide high gain, low noise and unconditionally stable operation through a wide temperature range, and include switchable FM traps. The amplifiers fit snugly into the Quantum's weather protected terminal housing.

**3. FM INTERFERENCE:** A growing problem with the FM boom. Quantum optional FM traps provide up to 25dB effective attenuation across the entire band without affecting the powerful front to back performance in any way. The printed circuit board traps are easy to install in the terminal housing.

**4. WEAK UHF PERFORMANCE:** The Quantum provides exceptional UHF power with an adjustable band span that permits you to market an antenna tuned to current and future UHF channels in your area. Gain as high as 13dB meets the critical demands of UHF color reception!

**5. IMPEDANCE MATCHING:** The Quantum provides an excellent match to both 300 and 75 ohm impedances! It uses insulation piercing terminals for 300 ohm hookup, and an optional balun/matching transformer for 75 ohm installation. The balun/matching transformer fits into the terminal housing.

## PLUS

**MASSIVE, ALL WEATHER POWER!** The Quantum has an extra rugged, double truss construction, wind tunnel tested to withstand better-than-hurricane force winds. The weather protected terminal housing on the massive twin boom provides a safe harbor for the Quantum's optional accessory components.

## ***CHANNEL MASTER QUANTUM***

One solution to every problem you're likely to meet---the Quantum Total Reception System!

## NEWS OF THE INDUSTRY

### 1974 Convention Exclusively NATESA's

The National Alliance of Television & Electronic Service Associations has announced that its next convention will be exclusively a NATESA affair. According to the announcement, the convention will be held at the Arlington Park Towers in Arlington Heights, Ill. It will begin Sunday, August 17, 1974, running through Monday, August 19, 1974. Included will be official business, seminars and social functions.

### Servicers' Net Profit Continues to Climb

Despite constantly rising wages and increased parts cost, "Service Only" operations were able to fashion a better Gross Margin in 1972 compared to the previous year, according to the Costs-of-doing-business Survey for service shops conducted by the National Appliance and Radio-TV Dealers Association.

"The better Gross Margin performance last year," stated James Renier, NARDA President, "stems from greater volume and increased productivity of technicians."

The Gross Margin went up to 41.4 percent of Sales, compared to 40.2 percent a year earlier, the Survey indicates. "However, the better Gross Margin was offset by higher Operating Expenses," said Mr. Renier. "After de-

ducting the Operating Expenses, the Net Operating Profit came to 5.8 percent of Sales—exactly the same as last year. Rising sales volume coupled with stable Operating Profits as a percentage of those sales is the sign of a healthy situation," said the NARDA executive.

The Cost-of-doing-business Survey, which will be distributed free to those firms which took part in its preparation, was cited by Mr. Renier as "a great contribution to the industry. Close to 200 respondents took part in the Survey in this, its third consecutive year of publication. It provides the only such benchmarks that are available to the trade and an on-going documentation of trends," said the NARDA President.

"For instance, we see the reassuring evidence that not only are Net Profits increasing—from 3.3 percent in 1970 to 5.8 percent in each of the last two years—but the salaries of proprietors and executives are also improving and are now up to 7.7 percent of sales. At the same time, truck expense is going down (in relation to total sales), again verifying the fact that managers are getting better production out of their technicians and vehicles.

An analysis of 28 different Operating Expenses, as a percentage of sales, is included in the NARDA Survey, together with a study of productivity of technicians, as derived from the computerized NARDA Service Data System.

"The industry statistics are valuable in measuring business trends," concluded Mr. Renier, "but service operators should be aware that variance from industry figures is not in itself a cause for either alarm or self-congratulation. Yet, each manager should take advantage of the 'work-sheet' portion of the survey to compare his own figures with those of his contemporaries." *continued on page 52*

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MODEL CJ-175

**\$89<sup>95</sup>**  
less picture tube

- ELIMINATES HAULING CABINET & TUBE
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- 4' 90 degree CRT Extension
- 4' Yoke Extension
- Convergence Load
- 4 Yoke adaptors for Solid State

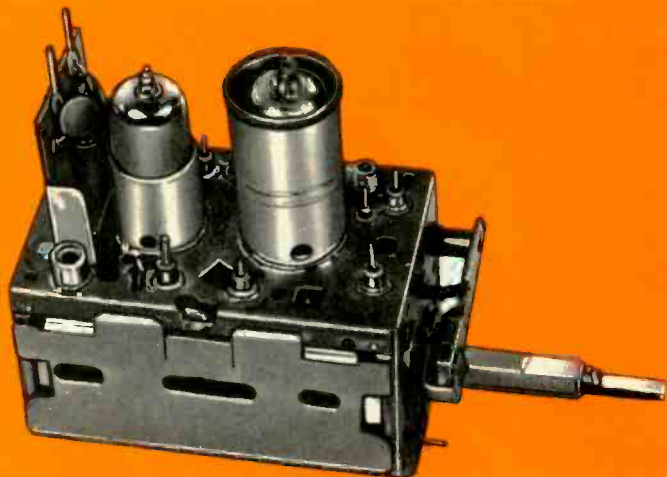


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In this price all parts are included. Tubes, transistors, diodes, and nuvistors are charged extra. This price does not cover mutilated tuners.

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All tuners ultrasonically cleaned, repaired, realigned and air tested.

### REPLACE

Universal Replacement Tuner \$9.95

This price buys you a complete new tuner built specifically by **SARKES TARIAN INC.** for this purpose.

All shafts have a maximum length of 10½" which can be cut to 1½".

Specify heater type parallel and series 450mA or 600mA.

### CUSTOMIZE

Customized tuners are available at a cost of only \$15.95; (with trade-in \$13.95)

Send in your original tuner for comparison purposes.



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<b>INDIANA</b>	Indianapolis, Indiana 46204	817 N. Pennsylvania St.	Tel: 317-632-3493
<b>KENTUCKY</b>	Louisville, Kentucky 40208	2920 Taylor Blvd.	Tel: 502-634-3334
<b>MARYLAND</b>	Baltimore, Maryland 21215	5505 Reisterstown Rd., Box 2624	Tel: 301-358-1186
<b>MISSOURI</b>	St. Louis, Missouri 63132	10530 Page Avenue	Tel: 314-429-0633
<b>NEVADA</b>	Las Vegas, Nevada 89108	3816 Vegas Drive	Tel: 702-648-1450
<b>NEW JERSEY</b>	Jersey City, New Jersey 07307	547-49 Tonnele Ave.	Tel: 201-792-3730
<b>NEW JERSEY</b>	Trenton, New Jersey 08638	901 North Olden Avenue	Tel: 609-393-0999
<b>OHIO</b>	Cincinnati, Ohio 45216	7450 Vine St.	Tel: 513-821-5080
<b>OHIO</b>	Cleveland, Ohio 44109	4597 Pearl Road	Tel: 216-741-2314
<b>OHIO</b>	Toledo, Ohio 43624	119 N. Erie St.	Tel: 419-243-6733
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<b>TENNESSEE</b>	Greeneville, Tennessee 37743	1215 Snapps Ferry Rd.	Tel: 615-639-8451
<b>TENNESSEE</b>	Memphis, Tennessee 38114	1703 Lamar Avenue	Tel: 901-278-4484
<b>TEXAS</b>	Dallas, Texas 75228	11540 Garland Road	Tel: 214-327-8413
<b>VIRGINIA</b>	Norfolk, Virginia 23502	4538 E. Princess Anne Rd.	Tel: 804-855-2518-9915

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**Warning: Independent Bookkeepers  
have determined that ordering any  
TV reception products without talk-  
ing to your Winegard distributor  
about his fall deal will be detrimental  
to your profits.**



Winegard Company—3000 Kirkwood Street—Burlington, Iowa 52601

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## BOOK REVIEWS

**QUESTIONS AND ANSWERS ABOUT PAY TV** by Ira Kamen, published by Howard W. Sams, 160 pages, paperbound \$4.95.

There are few subjects more controversial than CATV and Pay TV—at least for the readers of our publication. Often the two subjects are confused as being the same. A few of our readers support both, while others oppose both—particularly Pay TV—almost to the point of being violent!

Those that favor Pay TV can use this book to improve their understanding of what they favor; and likewise, those that oppose it can use the book to better understand their “enemy.” Whatever your position, the book should prove interesting.

One thing the book is not a guide to encoding and decoding techniques used for Pay TV. Such subjects are only covered lightly. Instead it is concerned with the history and current development of Pay TV systems—both those in the planning stages and those already in use: over

the air, through CATV systems, and isolated hotel/motel systems. This is a book that really goes into specifics.

**BUILDING & INSTALLING ELECTRONIC INTRUSION ALARMS** by John E. Cunningham, published by Howard W. Sams, 136 pages, paperbound \$4.50.

At first glance this may seem to be a book that would be appropriate for a hobbyist that was not concerned with making professional installations. After all, the value of one's professional time is too great to construct security systems completely from scratch. However, there is another way of looking at the matter. The schematics included with installation tips may be considered a training aid in assisting the technician as he becomes familiar with commercially available similar-type systems.

Virtually every type of security system is described in some basic manner in this book—everything from pressure-operated switches that trip relays and sound buzzers, to an ultrasonic intrusion detection system. The only system not including complete component schematics is for a closed-circuit TV

system, and it does include tips on how to connect an automatic alarm system to a TV monitor for observing changes in any pre-determined portion of the picture.

We feel that this is a well rounded book that will offer some assistance to the electronic technician attempting to electronically secure an area. It should prove a source of many excellent ideas, although not necessarily a complete source, since there are many lines of sophisticated products now on the market.



This may hurt a little. The picture tube will have to come out.

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1. All functions, ranges, and meter protected by fast relay, renewable link fuse, and diodes
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To buy: order from any one of the more than 1,000 Authorized RCA Distributors worldwide. For more information on RCA VOMs, request the new full-line 1Q1218F catalog from RCA Electronic Instruments Headquarters, Harrison, N.J. 07029.


**RCA** Electronic Instruments

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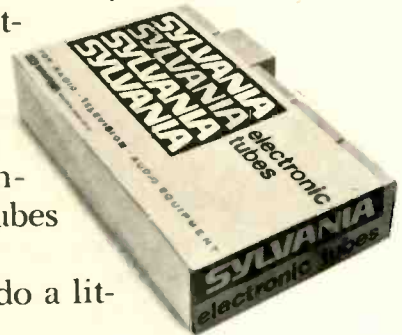
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## NEW AND NOTEWORTHY

For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly.

FOR MORE  
NEW PRODUCTS  
SEE PAGE 53

### CD-4 DISC DEMODULATOR 700

*Increases the versatility of existing stereo equipment*

A DC-4 disc demodulator is designed to reproduce discrete four-channel sound from all CD-4 discrete records. The unit can reportedly be connected between a stereo turntable and a four channel amplifier or receiver, demodulating the signal into four distinct channels. Sophisticated circuits employing both FET's and IC's are used with sound separation indicated on the front panel by a large, illuminated panel meter. Included is a test record to adjust the unit for maximum separation by a pair of left and right separation controls located on the front panel. There is also a three-position function switch to allow a choice between 2-channel, 4-channel auto and direct. The unit reportedly has a signal-to-noise ratio to more than 70dB and a frequency response of 20Hz to 15kHz. U.S. Pioneer Electronics Corp.



### TELEPHONE ANSWERING/RECORDING SYSTEM 701

*Includes most-wanted features at a moderate price*

The Tele-Tender Model K229 telephone answering and recording machine is reportedly designed to offer a range of the most wanted features found in machines priced considerably higher. The unit automatically answers your phone and records message on cassette tape. With a flick of the monitoring switch, you can listen to the call through the built-in speaker and decide whether to take the call or have the message recorded. By using the plug-in microphone you can record your outgoing message on the cartridge. In seconds you can dictate a new message as often as you like. The unit also has the capability to record all telephone conversations or use independently as a dictating machine or tape recorder. The unit operates on ac power and measures approximately 10 by 12 by 2 in. Accurate Merchandising Inc.



### MATV BROADBAND INDOOR AMPLIFIER 702

*For MATV installations  
served by CATV*

The Model DA-1V-75P indoor solid-state 75 $\Omega$  broadband amplifier has been redesigned to meet required CATV bandwidths. The unit reportedly covers a frequency range from 54MHz to 270MHz and therefore includes VHF, mid-band and super-band channels. The amplifier is ideally suited for use in master TV installations served by cable TV. The signal input capability is reportedly 27dB mv for 21 channel service at  $-57$ dB cross modulation. Minimum gain of the single output amplifier over the entire useful range of frequencies is said to be 9.5dB, with typical figures of 11.5dB in production units. The extended bandwidth of the amplifier reportedly provides usable gain at 300MHz, thus offering excellent color and B/W signals throughout the useful CATV spectrum. The unit may be mounted on a flat surface indoors and slots in the base flange accept a wide variety of mounting hardware. Blonder-Tongue Laboratories, Inc.



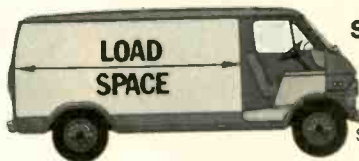


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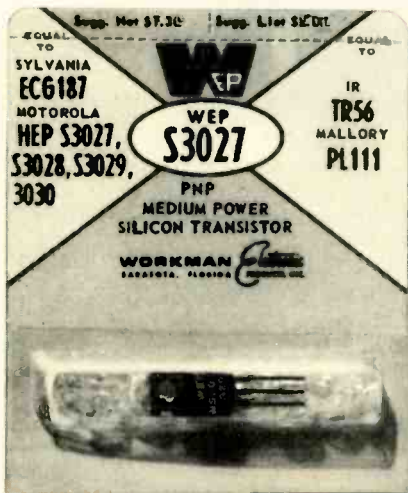


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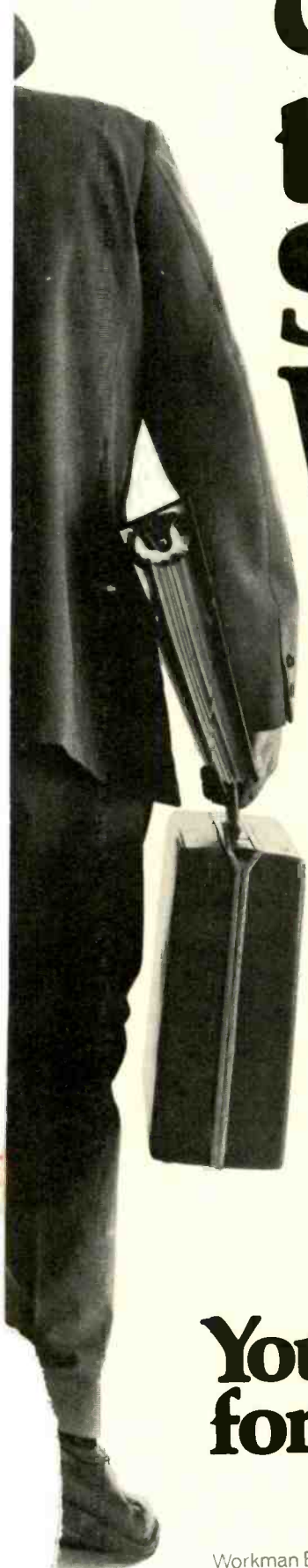
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Collector-Emitter Voltage	$V_{CE0}$	35	V <sub>dc</sub>
Emitter-Base Voltage	$V_{EB0}$	4	V <sub>dc</sub>
Collector Current	$I_C$	1.5	Amps
Total Dissipation	$P_D$	8	Watts
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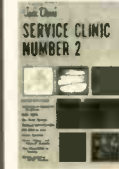
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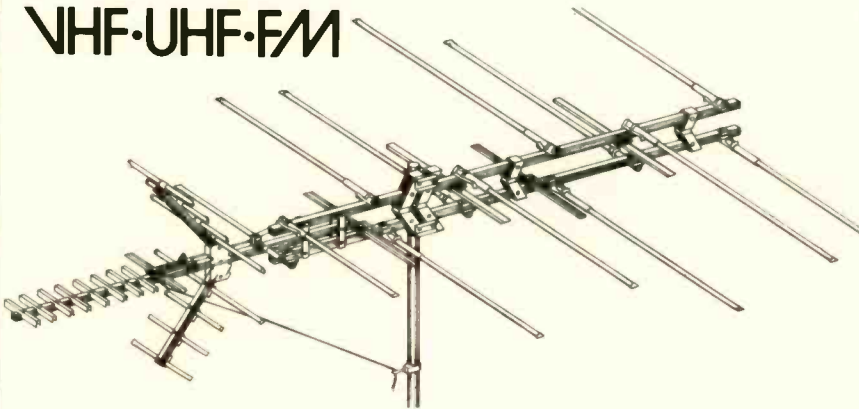
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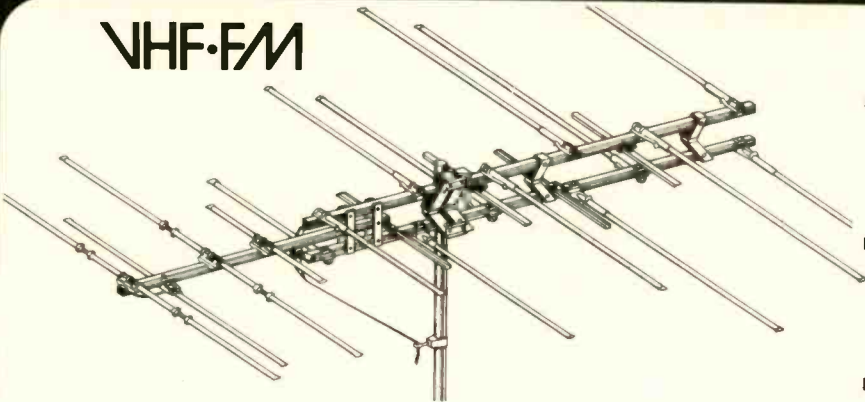
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**TEKLAB REPORT**

# Sylvania's Modular EO5 Color-TV Chassis

Part II—A new three-part color level monitoring circuit corrects most problems caused by signal changes

by Joseph Zauhar

■ The Sylvania Color-TV Model CX3178, received for our evaluation, came with the GT-Matic Color Tuning System and is almost completely automatic, eliminating many of the controls as customer adjustments. The only customer controls left on the front control panel is the ON/OFF VOLUME and CHANNEL SELECTION. The COLOR INTENSITY, TINT, CONTRAST and BRIGHTNESS controls are preset at the factory, but can be readjusted for personal preference if desired. Three automatic control circuits are combined to create an automatic color-level control system.

Last month we covered a number of cabinet and chassis features which we felt simplify any required servicing of this TV set. We also reviewed the Tuner and Video IF System, Noise Protection System, AFC and 31.5kHz Clock Circuits, plus the Count Down Integrated Circuit and the Brightness Limiting Circuits employed in this color-TV chassis.

The circuits employed on this chassis are logical-

ly grouped on three separate plug-in modules. The individual transistors and integrated circuits also plug-in, allowing two-way serviceability. If you should decide to service the chassis, a review of the circuits could prove to be helpful using the August TEKFAK Schematic No. 1484 as a reference.

### Automatic Color-Level Control System

The Automatic Color-Level control system consists of three automatic control circuits which function as follows: the Burst Detector for chroma ACC (Fig. 1, Block A/C); the Average Color Level Detector for controlling changes in scenes and maintaining large vivid color areas (Fig. 1, Block B); and the Threshold Detector for maintaining the peak color level. The system regulates the color signal and compensates for the variations normally found in color signal transmission, such as the overall chroma variation and the chroma-to-burst ratio change.

The amplitude of the

chroma and burst signal is maintained by feeding the differential ACC voltage, obtained at pins 15 and 16 and developed in the integrated-circuit IC606 synchronous burst amplitude detectors, to pins 1 and 14 of IC604. This action gives the APC detector of IC606 a constant amplitude burst signal for the 3.58MHz CW oscillator phase control.

### Chroma-Demodulator Circuit

The  $-(R-Y)$ -signal and  $-(B-Y)$ -signal are recovered by a pair of synchronous detectors operating on the  $R-Y$  and  $B-Y$  axis in IC602 and by internal matrixing of the signal in the IC we produce the  $-(G-Y)$ -signal.

A phase-lag network (Fig. 2) corrects the CW signal obtained from pin 2 of IC606 and an additional phase network between pins 6 and 7 of IC602 to produce an additional delay to the CW signal applied to pin 7. The delayed CW and chroma signal are then fed to a pair of synchronous detectors to recover the

color difference signal  $-(R-Y)$  and  $-(B-Y)$ .

### Perma-Tint Circuit

The Perma-Tint action is accomplished by switching on diode SC670 (Fig. 2), bringing its cathode to ground through switch SW606 and in effect adding reactive components—capacitor C676 and resistor R670—to the CW circuit—IC602, pin 7. The addition of these phase shift and amplitude changing components spread the demodulation axis from  $90^\circ$  to about  $120^\circ$ .

When diode SC670 conducts, capacitor C676 and resistor R670 are in effect brought to ground, increasing the lag in the  $B-Y$  CW signal phase. When C676, R670 and capacitor C650 are paralleled, the reactive loading reflected to terminal pin 6 increases as capacitance loading to pin 7 occurs. This additional loading makes pin 6 of IC602 see an inductive increase, causing the  $R-Y$  CW phase to shift to the leading side and the  $B-Y$  CW signal to shift to the lag-

ging side, causing the de-modulation angle to be increased when Perma-Tint action takes place.

### 3.58MHz CW Oscillator

The 3.58MHz oscillator

signal is generated by the positive-feedback signal from integrated circuit IC606, pins 7 and 8, applied to pin 6 through the feedback network (see August TEKFAV Sche-

matic No. 1484). This network consists of crystal XT600 and capacitor C694. Capacitor C692 is a phase shifting network. Signal phase shift between pin 6 and pin 7 in the feedback circuit should be zero to sustain frequency.

Differential voltage developed by the APC detector determines the CW signal amplitude at pin 7 and pin 8. The phase of the CW signal at pin 7 is determined by the relative amplitude of the CW signal at pin 6 and the phase shift of the CW signal at pin 7 introduced by the APC voltage. The APC voltage initially controls the frequency and then the phase of the CW Signal.

### CW-Blanking Circuit

The 3.58 oscillator signal is blanked by an integrated positive flyback

pulse at pin 4 of IC606. Turning OFF the oscillator signal during flyback removes the CW signal and the possibility of burst demodulation, eliminating the color bar on the left side of the screen. Resistor R684 and capacitors C689, C688 and C686 form the integrator network that shapes the leading edge of the pulse to coincide with burst time.

### Color-Control Circuit

The COLOR control, located at the top rear edge of the cabinet, is factory preset, although it may be adjusted by a technician for the customer's personal preference if desired.

The color control circuit consists of a PREFERENCE LEVEL control R632, a bias network and resistors R628, R630 from the 24v source to ground, which adjust the threshold of transistor Q604, setting its conduction level. Transistor Q606 is in an emitter-follower configuration. As the forward bias of

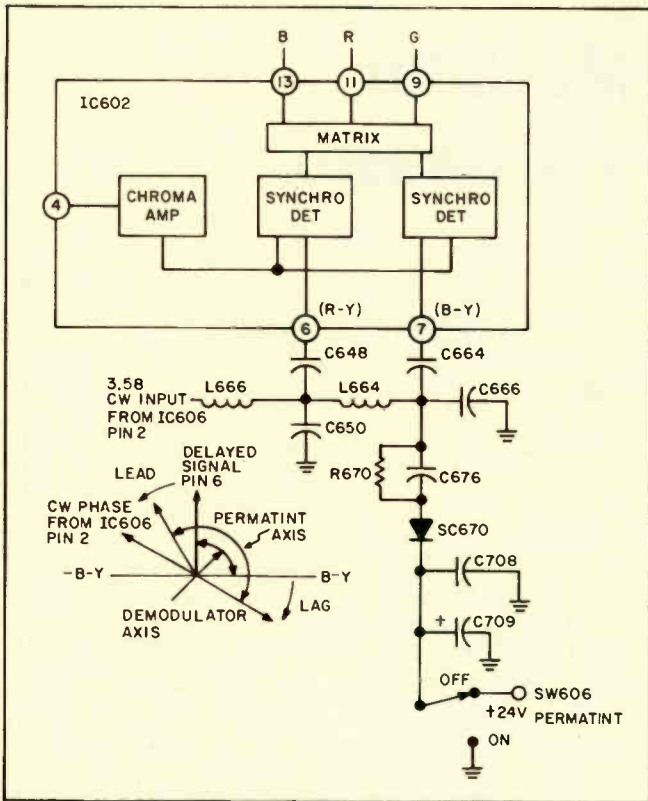


Fig. 2—A simplified block diagram of the Chroma Demodulator and Perma-Tint circuits. Courtesy of GTE Sylvania Inc.

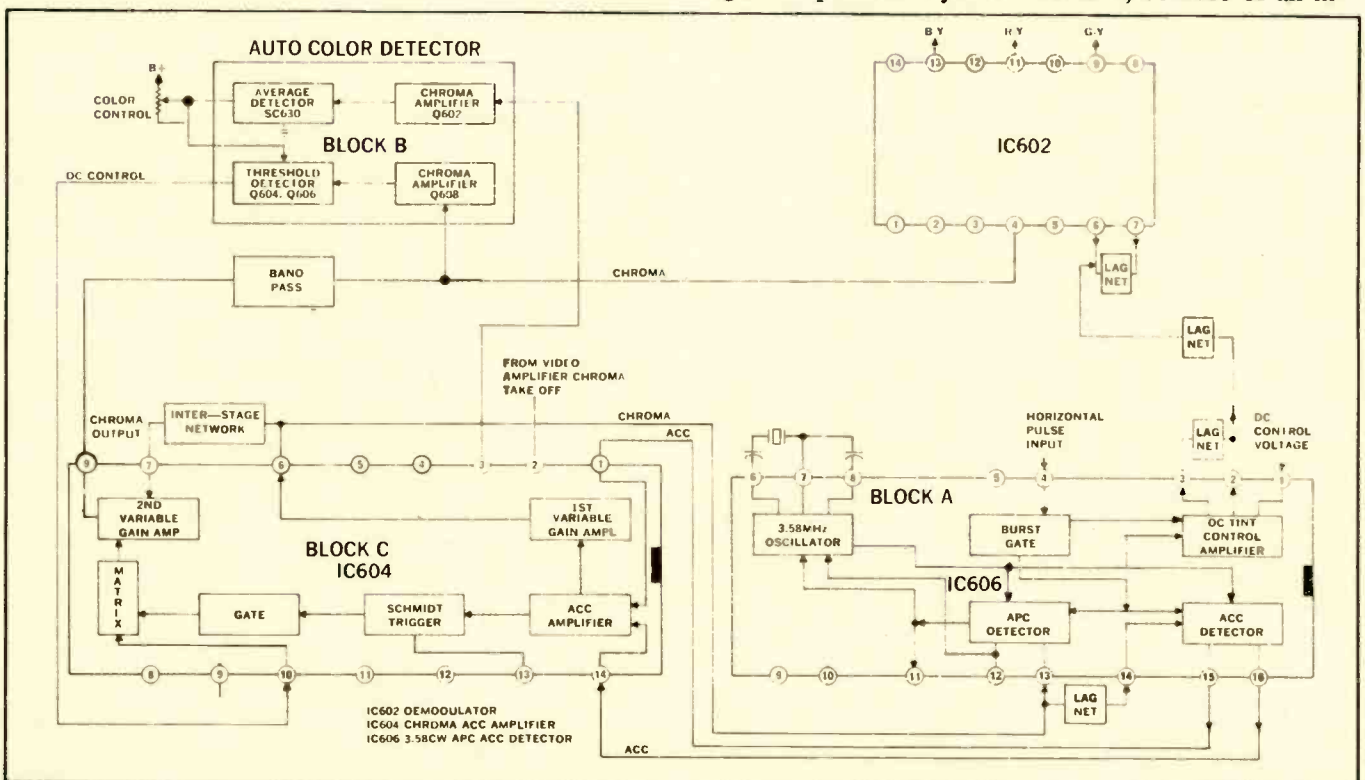


Fig. 1—Block diagram of the Automatic Color Level Control system employed in Sylvania's E05 Color-TV chassis. Courtesy of GTE Sylvania Inc.



crease in chroma signal, the voltage is developed and stored in capacitor C608, increasing the voltage at the emitter of Q606 and reducing the gain of the chroma amplifier in IC604. A low chroma signal at the base of Q604 will decrease its forward bias and capacitor C608 will not be able to store the charge, reducing the voltage at the emitter of Q606, which in turn will increase the gain of the chroma amplifier, increasing the chroma signal. The

voltage at pin 10 of IC604 will range from approximately 3v to 20v, providing a color range from maximum to no color.

### Tint-Control Circuit

The Perma-Tint circuit reduces flesh-tone variations from scene to scene. The ON/OFF switch for the Perma-Tint circuit is found in the lock-away control center at the top rear edge of the cabinet.

The TINT control (Fig. 3), R690, is the variable resistor in a parallel re-

sistance voltage divider that controls the differential gain in amplifier transistors Q2 and Q3 in integrated circuit IC606. The control setting introduces a differential voltage at the bases of Q2 and Q3, which controls the

relative amplitude of the oscillator signal at pins 2 and 3 of IC606.

Both amplifier collectors have the same signal phase, but the amplitudes are different. When the C'W signals are matrixed at pin 2 of IC606, a de-

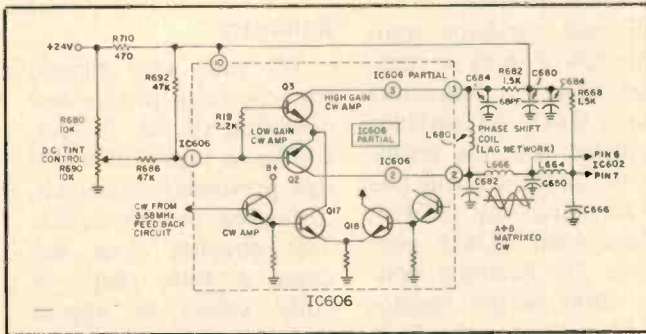
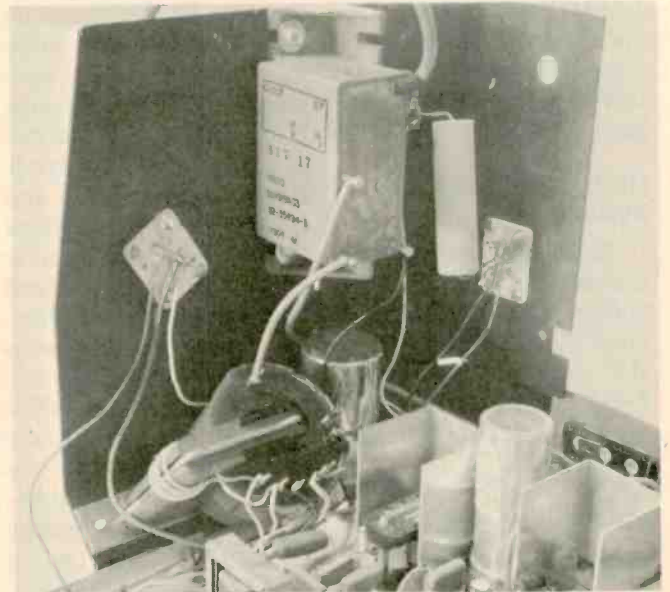
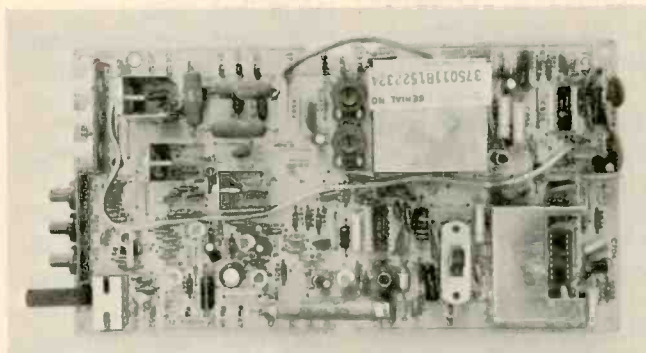


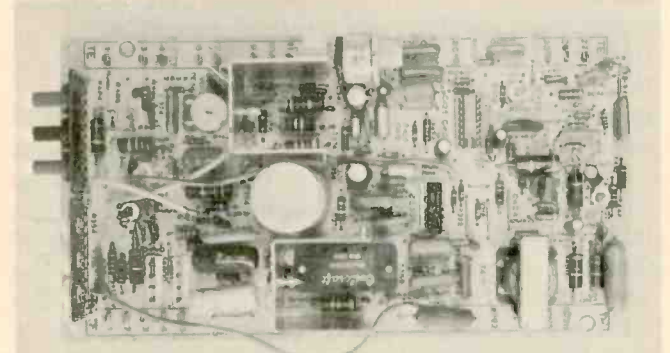
Fig. 3—Simplified schematic of the Tint Control circuit. Courtesy of GTE Sylvania Inc.



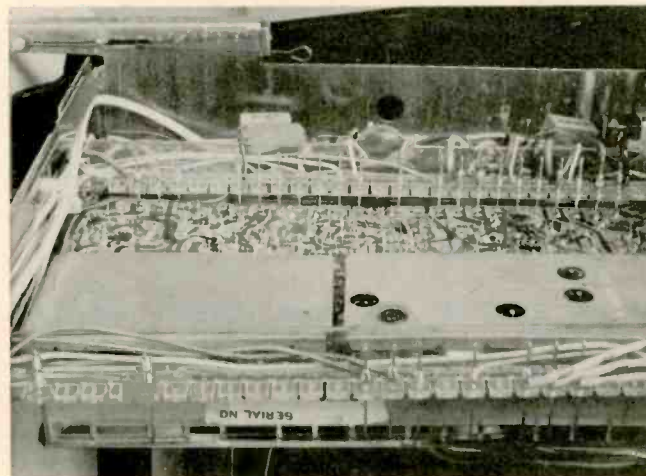
The horizontal-output transformer, high-voltage tripler, horizontal-output transistor, B+ regulator transistor and capacitor are all mounted on the main chassis.



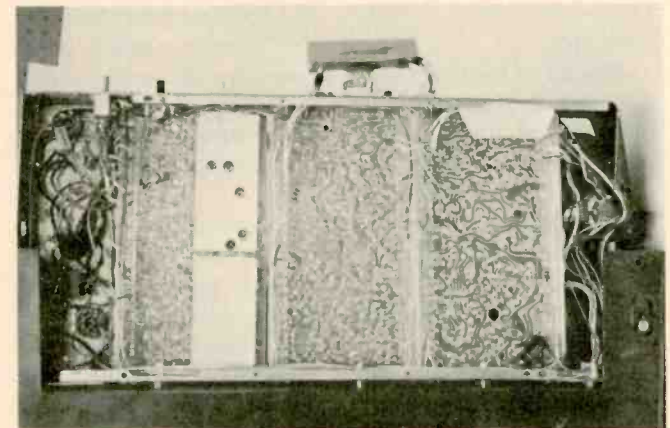
The Automatic Color-Level Control circuits are all located on the chroma panel, simplifying troubleshooting of the circuits.



The deflection panel is one of the three used with plug-in features, and it can be serviced by module replacement or conventional methods.



Bottom view of the chassis, showing the module pin connectors.



After the rear cover is removed, the underside of the chassis is completely exposed.



layed signal phase is produced by a network consisting of coil L680 and capacitors C684 and C682. This delayed signal is added to the non-delayed signal on pin 2, resulting in a phase shifted 3.58MHz CW signal. The TINT control setting determines the resultant 3.58 CW phase to the demodulator IC602.

### Horizontal-Sweep System

The horizontal output transformer, T400; high-voltage tripler; horizontal-output transistor, Q406; B+ regulator transistor, Q412; and capacitor C508 are all mounted on the main chassis.

The divider (pin 2 of IC300), the horizontal-drive pulse, is square wave in nature and coupled to the horizontal-driver transistor, Q404, for switching it ON. Current flows through T440, the driver transformer winding, and transformer action couples the pulse energy to the horizontal output transistor, Q406.

Capacitor C436 charges when the base current of transistor Q406 flows through resistor R450. This charged capacitor serves as a power source at TURN-OFF time of transistor Q406 to aid in generating a negative base current to speed up the TURN-OFF time of the transistor.

When the base of Q406 is forward biased by the transformer coupled pulse, it is saturated (i.e., the collector is effectively at ground potential) and the current increases through the primary winding in T400 and the horizontal deflection coils.

The coils' reactance opposes the current increase, producing a linear magnetic field in the yoke

coils, and the picture-tube beam moves from the center to the right. When the forward bias pulse to transistor Q406 is turned OFF, its base goes negative, helped by discharging capacitor C436 through resistor R450. The magnetic field in transformer T400 and the yoke coils now collapses. This collapsing field produces a rapid rise in voltage across capacitor C442, diode SC450 and transistor Q406. Since Q406 is now non-conducting, all the energy stored in the yoke and transformer T400 is transferred to capacitor C442. This capacitor forms a parallel-resonant circuit with the horizontal yoke and the primary of T400, and begins to transfer energy back to the yoke. During this half cycle of resonance, yoke current rapidly reverses direction, moving the picture-tube beam from the right to the left side of the screen.

### Damper-Current and Boost Circuit

When all the energy is transferred from capacitor C442 to the yoke, the cathode of SC450 starts to go less than ground potential. It then conducts and clamps a constant voltage across the yoke and transformer T400, causing a linear decay in the magnitude of the yoke current sweeping the picture-tube beam from the left to the center of the raster. At this time, Q406 again starts to conduct and the cycle repeats itself.

Boost diode SC445 is turned ON by the high-voltage pulses developed by the collapsing fields of the horizontal yoke and transformer T400—during transistor Q406 TURN-OFF time, applying the pulse to capacitor C440

for charging it to the peak collector voltage on Q406. This voltage is applied across a resistance network consisting of resistor R488, the SCREEN controls and resistor R490.

### High-Voltage Limiter

Diode SC402 (Q402) is connected to the base circuit of the horizontal-driver transistor, Q404, along with zener diode SC435 and resistors R444, R442 and capacitor C432 to form an overvoltage protection circuit.

Should regulator transistor Q412 short or regulator-driver transistors cause Q412 to produce excessive B+, the resulting rise in the 120v dc line is measured by SC435. When zener SC435 conducts, the resulting voltage drop across resistor R442 gates ON the SCR (Q402). When the SCR is fired, the horizontal drive transistor is clamped OFF by bringing the divider network (resistors R438 and R440) junction to about ground potential. This action kills the horizontal drive, eliminating possible anode voltage.

Once SCR Q402 fires, it stops circuit conduction, even though the circuit malfunction has cleared itself. To restore sweep and high voltage, the set must be shut OFF to interrupt the SCR conduction. Should the overload condition still exist, the SCR fires, killing the horizontal drive again.

### Vertical-Sweep System

The power section is a quasi-complementary output circuit operating in Class AB and having extremely high impedance and current gain. The input and output waveforms are essentially the same. Cross-over distortion is prevented by biasing both power

transistors slightly above the turn ON point with the voltage drop across the resistor/diode network (resistor R358, diode SC355). Idle current stabilization is established by resistors R364 and R366 in the output circuits.

The configuration of Transistors Q306 and Q310 provides a high-gain, high-current PNP equivalent with a beta product of both transistors—a type of Darlington configuration.

### Summary

We were very pleased with the color picture and operation of the TV set. Unlike so many other TV sets previously examined, activating the Automatic Tint circuitry does not cause a wide range of other colors to appear flesh tone. With this set you don't see those brass rails or gold titles appearing in flesh tones.

A check was made on the low-voltage regulator circuit by dropping the ac line voltage to 83v ac before we noted margins or notable changes in picture quality on the screen. The noise protection and vertical countdown circuits provided excellent horizontal and vertical sync even under extreme noise conditions.

The plugability concept provides a serviceability boon for the TV service technician. He can now service with complete board substitution or plug in individual integrated circuits or transistors allowing two-way serviceability.

The GT-Matic system should eliminate many of the unnecessary service calls that might otherwise be required to show the customer how to use the manual controls for good quality color-TV pictures.



# A Look at the 1974 TV Sets—Part I

by Joseph Zauhar

In-line color picture tubes, simplified tuning, extended warranties and modular chassis are playing an important role in TV sets for the coming year

■ Most TV set manufacturers have already shown their new TV sets for the coming year and they appeared to have worked toward a common goal of not only simplified adjustments for the customer, but the service technicians as well.

Probably the most important feature for the coming year in many TV sets is the use of the in-line, slotted-mask picture tube. It employs a toroidal deflection yoke bonded to the outside of the tube, eliminating the need for dynamic convergence and making the installation of the color picture tube almost as easy as that in a B/W-TV set.

We will see more one-button tuning with preset controls to simplify tuning of the TV set for the customer, while still allowing the ability to adjust for personal preference. One manufacturer has completely eliminated the VERTICAL HOLD as a customer control.

A new Five Point Protection Package that includes one-year free parts and labor, five-year picture-tube adjustment, a color-TV loaner and a toll-free "hot" line for customers is offered by Admiral.

Channel Master is introducing a 19-in. (measured diagonally) screen color-TV portable with remote control.

Many Electrohome color-TV chassis employ a super-module approach, enabling the service technician to return the entire chassis to the company for repair, realignment and testing—then returned for field replacement.

General Electric's modular solid-state chassis has improved One Touch Color circuitry, a new control arrangement and an increase in the picture-tube anode voltage to 28.5kv.

Magnavox's new color-TV will feature Videomatic, which automatically adjusts its own picture to changes



The Orinoco Model 5L5733 is one of eight new Admiral Super-Solarcolor TV consoles featuring a 100 percent solid-state chassis. Courtesy of Admiral Corp.

in room lighting conditions, one-button tuning, brighter picture tubes and a 100 percent solid-state modular chassis.

Motorola's major effort was made in their cabinetry line, "noise immune" remote control, higher high voltage, and negative band matrix color picture tubes.

In our Teklab report each month we will be reviewing many of these new TV sets, giving an explanation of circuit functions—including photos and schematics of the TV sets.

## ADMIRAL

Highlighting Admiral's color-TV for 1974 is a new Five-Point Protection Package. It reportedly includes one-year free parts and labor on all models in its color-TV line, plus a five-year picture tube adjustment warranty, a color-TV loaner program and a toll-free "hot-line" for customers with service problems.

The new color-TV line of 40 models offers a broad variety in screen size, styling and price. There are 16 portable and table models, providing a choice of six screen sizes, from 12-in. to 19-in. All 24 console models are the popular 25-in. (measured diagonally) picture size.

The new Modular SS1000 color-TV chassis is 100 percent solid state and is used in eight deluxe console models. Most circuit functions are controlled by nine color-coded modules. These modules are plug-in and the chassis slides out for easy access and fast service.

All but four models include the new "Color Master V" one-button control. This system is a push bar that locks in the Automatic Fine Tuning and adjusts COLOR, TINT, BRIGHTNESS and CONTRAST to preferred settings. If the factory preset adjustments are not exactly to the customer's liking, he can re-adjust them himself.

Other improvements include more extensive use of the Super-Solarcolor black matrix picture tube and 70-position detent UHF tuning. All models include the "Instant Play" feature.

Two top-of-the-line models include Instant Electronic Touch Tuning. To change channels (all VHF channels, up to six UHF channels), the viewer simply touches the number of the channel he wants on the set's control panel. The change is noiseless and instantaneous, and the channel number appears as a lighted digital read-out next to the screen.

A remote hand unit works in conjunction with this electronic tuning system to provide better remote control capability. A unique feature of the remote unit is the Automatic 60-Second Silencer, a MUTE button that kills the sound for one minute, then returns it to the previous level. To restore the sound, the viewer presses the MUTE button again.

Introduced are four new models in two completely new screen sizes—three 13-in. models and two 17-in. models. The TV sets will use the new SS900 Chassis, which is 90 percent solid state, with the Super-Solarcolor picture tube, "Color Master V" five-in-one touch bar tuning, and detent UHF. The SS900 chassis employs 27 transistors, 30 diodes and four integrated circuits, plus seven receiving tubes—with plug-in modules for easy servicing.

Admiral is making a major effort in the "take-along" B/W-TV models. The line leads off with four 9-in. and four 12-in. models, offering a broad variety of cabinet colors, styling and functional features. One 9-in. and one 12-in. model come with a detachable 360° swivel pedestal base.

Four models in the line feature a new 100 percent solid-state chassis. This deluxe ensemble features "Instant Play"; slide controls for VOLUME, BRIGHTNESS and CONTRAST; 70-position "click" UHF tuner; plus a packed-in stand.

In the large screen category, there will be three 22-in. models—two consoles and one table model that comes with a roll-about cart. All three models feature "Instant Play," a slide VOLUME control and a 70-position UHF tuner.

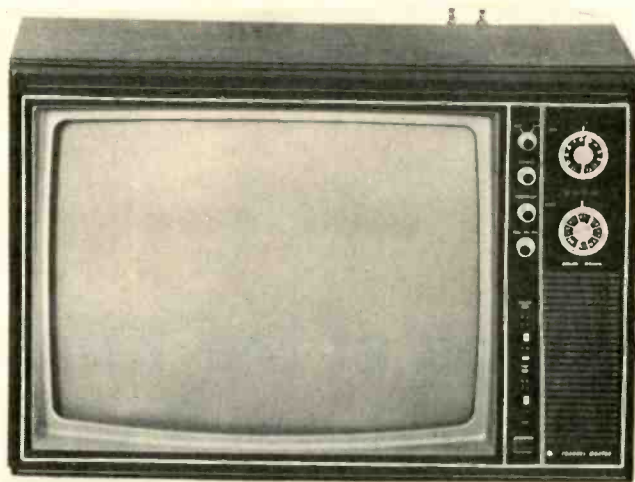
## CHANNEL MASTER

Channel Master's new color-TV line will feature eight new products: One 15-in. portable; three 19-in. portables and four 25-in. consoles.

The Model 6127 is a 19-in. (measured diagonally) screen color-TV portable with a wireless remote. It features 100 percent solid-state integrated circuitry, black matrix picture tube and "Auto-Color," which reportedly locks-in the COLOR, TINT and FINE tuning when channels are changed. The independent remote unit controls the VOLUME, ON/OFF, UHF and VHF tuning. Combined with pre-set Auto-Color, it provides maximum tuning ease and convenience for the viewer.

Other features include: slide controls for COLOR and TINT, an earphone jack, attractive wood-grain finish cabinet, an automatic brightness limiter, an automatic GAIN control, automatic degaussing, front-mounted speaker, side slots for easy lifting, and an eight-position resettable UHF detent tuner.

The 25-in. (measured diagonally) screen color-TV consoles features the 100 percent solid-state Integrid

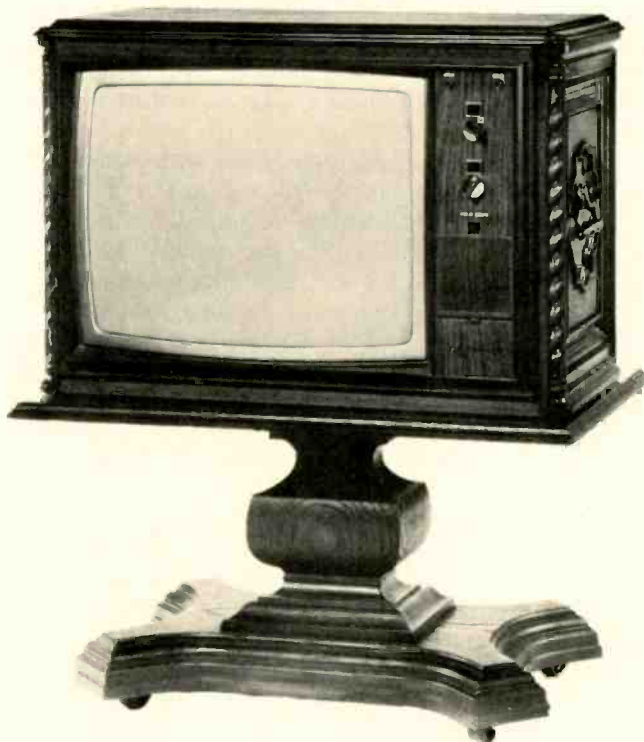


Channel Master's Model 6127 Color-TV portable featuring remote control. Courtesy of Channel Master.

chassis for dependability and ease of service. The chassis employs five plug-in modular circuit boards that perform separate functions. The TV set features Instachrome Auto-Color circuits which controls the COLOR, TINT MODIFIER, CONTRAST and BRIGHTNESS settings and maintains their balance through varying studio lighting conditions. Although the Instachrome system comes preset, the control can be easily reset in the home for changing color preference. Other features include Automatic Fine Tuning (AFC), Automatic Dynamic Correction Circuit, Automatic Degaussing and Instant-On. A Chroma Grid black matrix picture tube is used with full three-year warranty.

## ELECTROHOME

In Electrohome's color-TV line there are several 26-in. consoles, three of which highlight electronic varac-



The Palomar, a 20-in. (measured diagonally) Color-TV set highlighting a unique Spanish styling, is presented by Electrohome. Courtesy of Electrohome Limited.



tor tuning, a remote control unit, plus a full spectrum of furniture styles and finishes.

A new center/detent control function has been added to the "Electromatic" chassis series which permits color density, tint and fine tuning to be locked in automatically or each manually adjusted to the customer's preference. An automatic brightness circuit, which adjusts to room lighting, is another feature along with a direct shield 75Ω cable antenna connection.

The color-TV chassis employs a super-module approach and retains all of the automatic controls for consumer ease of operation. If a difficult problem occurs, the entire solid-state chassis can be removed quickly and replaced with a new factory-aligned chassis right in the home. The chassis is removed, then returned to the company, repaired, realigned and tested, then factory "sealed" for re-installation in the field.

There is also a wide range of color-TV styles in 20- and 22-in. screen sizes including a Spanish style with matching pedestal base.

The B/W TV line will include portables with 16-, 20- and 21-in. screen sizes, plus six 23-in. consoles. A 12-in. solid-state unit, which operates from the battery of a car or boat, is also available.

## GENERAL ELECTRIC

General Electric's new 25-in. (measured diagonally) color-TV receivers will use the 25MB modular solid-state chassis, which is completely solid-state except for the picture tube. This chassis and the preceding 25MA chassis both employ 10 plug-in modules and a quick service back. The new TV receiver has an improved One Touch Color circuitry, a new control arrangement and an increase in the picture tube anode voltage to 28.5kv.

The primary control panel has the POWER SWITCH button (push ON—push OFF) located underneath the



General Electric's Model MB9167DS 25-in. (measured diagonally) console color-TV set features a One-Touch color system. Courtesy of General Electric Co.

UHF selector and to the right of the One Touch Color AUTO button. In between the two buttons is a colored bezel which lights up when the AUTO button is pushed to its ON position. The slide VOLUME control is located above the VHF selector.

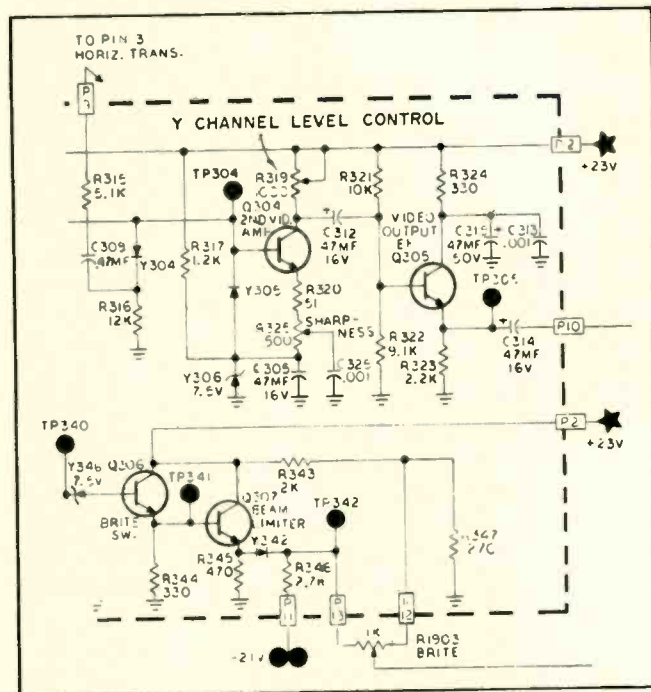
The secondary controls are mounted on the panel of a tilt-out bin assembly the same as in the MA chassis. There is no TINT LOCK switch since this function is automatic in the MB chassis models. An AFC slide switch (ON-OFF) is located on the right side of the bin.

The chassis controls are like the MA chassis controls except that the tint lock function is automatic and the AFC switch has been added for use in the MANUAL position. In the MANUAL position of the One Touch Color AUTO button (light out), the control functions are the same as the MA functions with full range COLOR and TINT controls and no TINT LOCK (same as position zero on MA TINT LOCK switch). The new AFC switch allows AFC to be either ON or OFF in the MANUAL position.

In the AUTOMATIC position of the AUTO button (light ON), the COLOR and TINT controls have limited ranges and AFC is always ON as with the MA controls. Also the tint lock is switched in to a degree that is similar to TINT lock switch position 1 on the MA models. The new AFC switch is inoperative in the automatic position.

The new solid-state QA color-TV chassis are the next generation of the JA chassis featuring One Touch Color circuitry, 100 percent dc restoration of the video signal, HORIZONTAL CENTERING control and increased high voltage. This increase of approximately 1.5kv over the 19JA chassis is accomplished by changing the number of turns in the high-voltage transformer, increasing its air gap and changing the value of a damper capacitor.

Slotted mask picture tubes will be used in the 10-in.





models and the Spectra-Brite IV picture tubes will be used in the 19-in. models. In all other respects the QA chassis is similar to the JA chassis.

The new 10HE color-TV chassis is a continuation of the H series of the Porta Color TV receivers. An improved picture tube requiring additional focus circuitry will be used in the 10HE chassis. The majority of the new models will employ a slotted-mask, striped-phosphor type of picture tube (10VADP22). The remainder will use a standard aperture mask, dotted phosphor arrangement (10VABP22). While retaining the basic in-line gun system, both of the new tubes will reportedly offer superior performance when compared to the 11WP22 used in the HD chassis. Higher light output levels are achieved primarily through higher glass transmission. Low-wattage filaments for reliability and better focus are obtained by a redesigned gun structure.

The customer controls, service adjustments and tuners will carry over essentially unchanged from the HD to the HE color-TV chassis.

The physical layout of the 10HE chassis will be slightly modified to accommodate the additional focus circuitry and to improve serviceability by mounting the power-supply components on a separate printed-circuit board.

A new 70-detent UHF tuner will be used in most models with a digital readout through a window on the front panel, making UHF tuning similar to VHF.

The SF chassis continue to be used in the new line with 9-, 12-, and 15-in (measured diagonally) screen sizes.

## MAGNAVOX

Magnavox's new color-TV line will feature the Videomatic, which adjusts its own picture to changes in room lighting conditions automatically, one-button



Digital Remote Control and Videomatic circuitry are featured on the Magnavox Model 4755, which is available in an Early American Style. Courtesy of Magnavox Co.

tuning, brighter picture tubes and 100 percent solid-state modular chassis. (This year over 90 percent of the color-TV line will feature solid-state modular chassis.)

Reportedly all of the 17-in. and 19-in. (measured diagonally) screen color portable and table models will employ in-line matrix picture tubes. All of the 25-in. consoles will employ improved negative matrix picture tubes, "Tune-to-Light" Digital Remote tuner and Magnamatic two-button remote control.

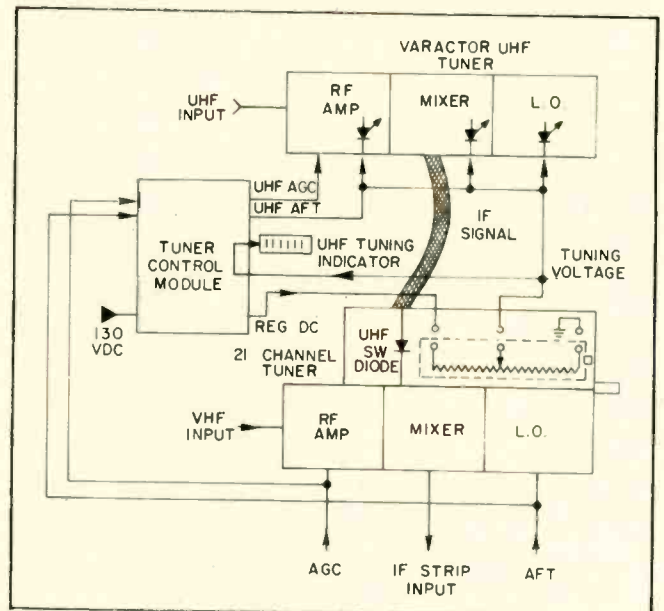
The T981, T982 and T987 all solid-state color-TV chassis are introduced this year for use with small screen, in-line picture tubes using the RGB color circuits. The T981 in the 17-in. portable models, the T982 in the 19-in. portables and the T987 chassis in the 10-in. decorator models. With minor exceptions the chassis are all identical.

The T981 chassis consists of two main circuit boards and 14 or 15 plug-in modules. The Signal Board Assembly is mounted vertically, containing modules and components used in the video, IF, sound, chroma, AFT and signal processing circuits. Also, on some models the board contains a Videomatic Module. The Scan Board Assembly is mounted horizontally, containing modules and components used in the vertical and horizontal scan circuits, including the video output circuits.

The sound, high-voltage, vertical-scan, video-output and parts of the horizontal-scan circuits are basically the same as those used in the T989 or earlier models.

The new line of color-TV sets employs a new Videomatic color system. Like the previous Videomatic models, the new system still uses the Light Dependent Resistor (LDR) to monitor room light and adjust the picture, but now also does much more. Now if the button is pressed, the picture is automatically fine tuned and the BRIGHTNESS, CONTRAST, COLOR and TINT are adjusted to a preset level. The customer can still use the controls but they are now limited to about 30 percent of the normal range, although the preset controls can be adjusted to suit an individual customer.

To provide more brightness and better focus, some  
*continued on page 52*



Block diagram of Magnavox's UHF varactor tuner. Courtesy of Magnavox Co.



# Another Approach to Hi Fi

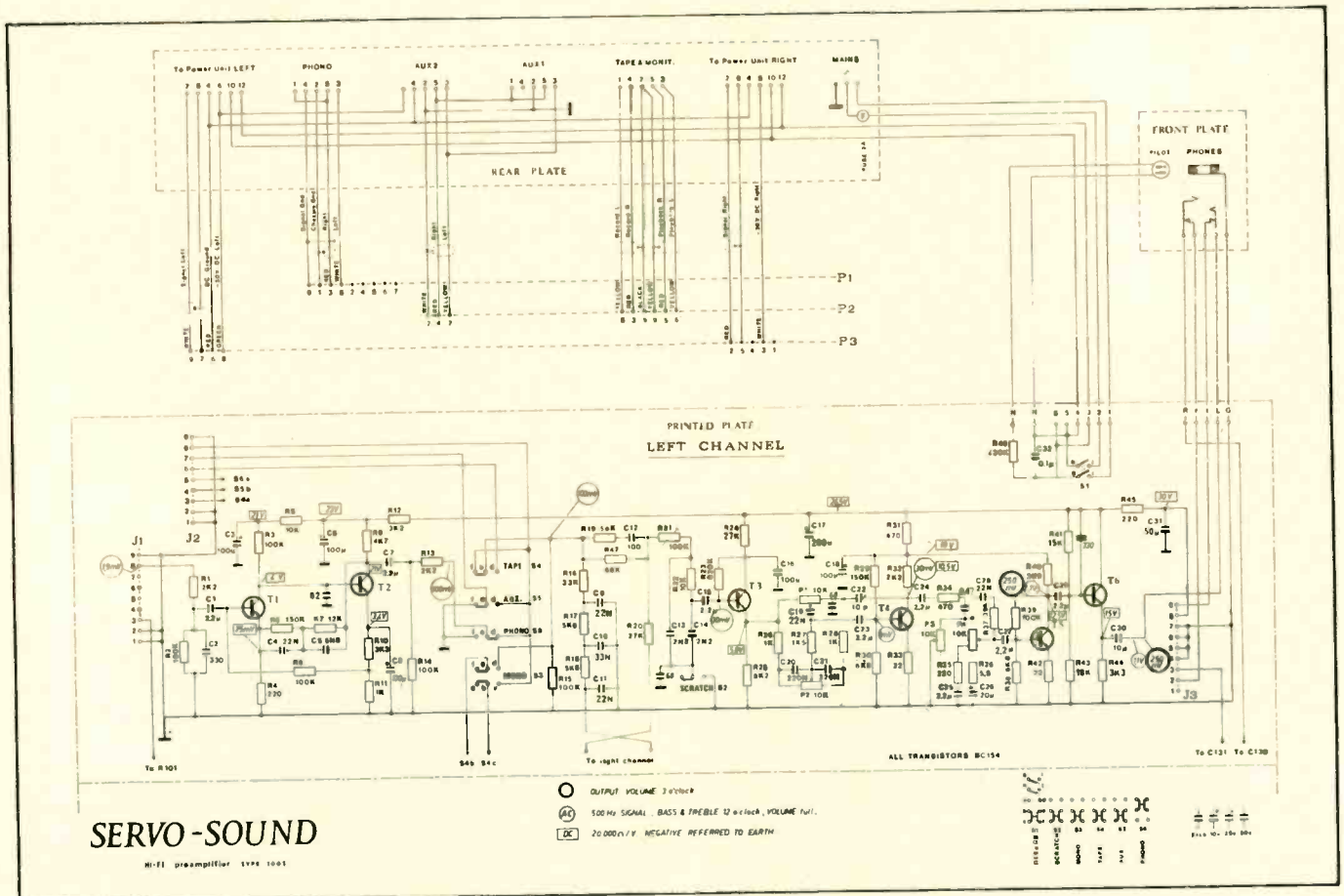
by Phillip Dahlen

We've never seen it done like this before

■ A while back we received some rather unusual circuit descriptions in audio literature obtained from Servo-Sound America, Inc., a company selling audio systems manufactured by the parent company in Belgium. Both the company name and the name of the particular unit that they were promoting—"Cybernetic Hi-Fi"—caught our attention. We found that these names were derived from the fact that the audio system senses the signal conditions present at both the speaker and power amplifier input, compares the two, and provides an automatic correction factor—a form of negative

feedback. This correction factor is determined by a special integrated circuit. Thus the system is designed to compensate for, and eliminate, distortion resulting from inherent speaker characteristics.

Upon obtaining a sample system for evaluation, we were surprised to note that the speaker housing contained not only the speaker, or the speaker in conjunction with some signal correcting circuitry; but rather the speaker, a power amplifier containing the corrective circuitry, plus the ac power supply—one complete system in each speaker cabinet! With but two speaker cabi-



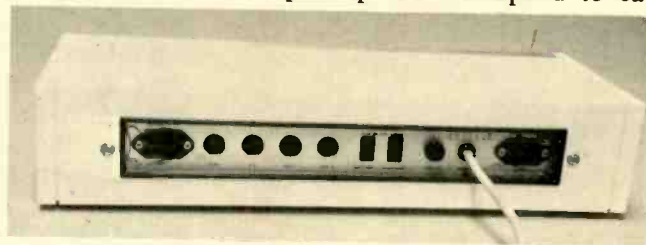
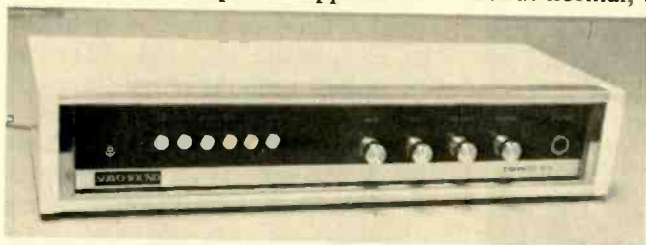
nets, the system is rated at 30w r.m.s. of audio output. However, each speaker cabinet contains an additional socket so that numerous speaker cabinets can be connected in series until you have a total audio output of 1000w r.m.s.

The separate preamplifier cabinet contains but the preamplifier, power cord, all customer controls, plus sockets for signal inputs and speaker-cabinet cables. All other circuitry is contained in each speaker cabinet. Thus the ac power applied to

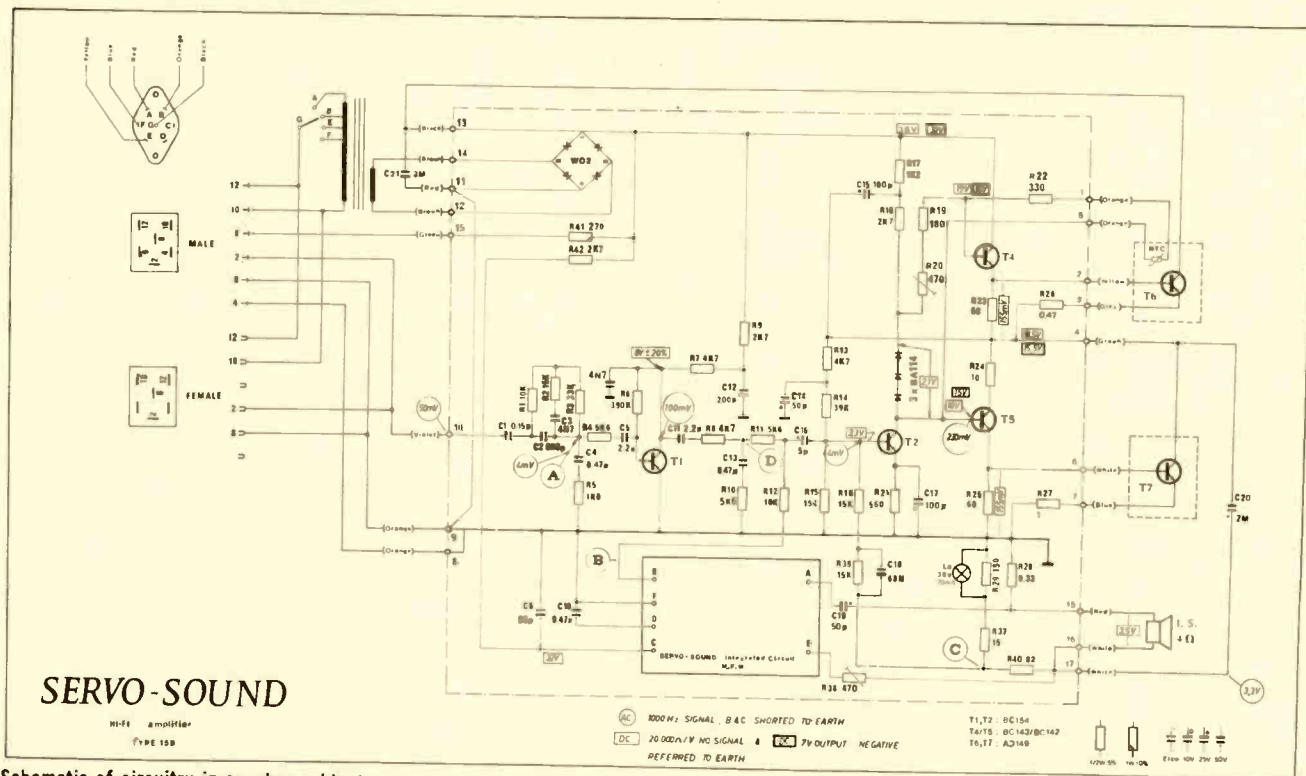
the preamplifier cabinet is forwarded to the speaker cabinets and the resulting dc bias voltage is returned to power the preamplifiers (one preamplifier receiving its bias voltage from one speaker cabinet and the other preamplifier receiving its bias voltage from the other corresponding speaker cabinet. Additional speaker cabinets receive ac power but do not return bias voltages.) As a result, although the weight of the speaker cabinets feel about normal, the preamplifier cabi-

net is so light that it feels nearly empty.

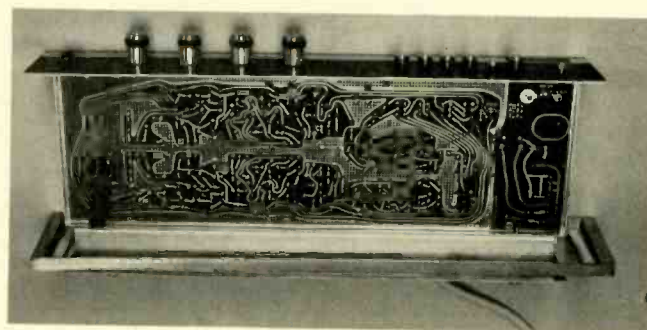
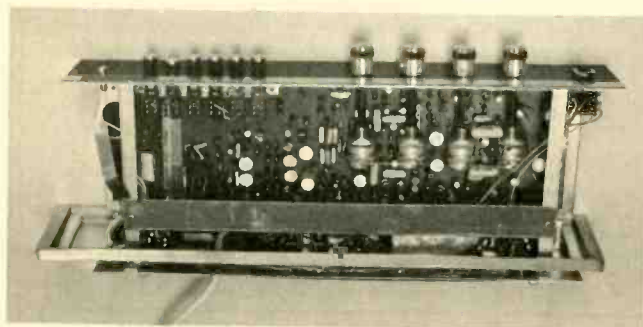
The schematic for circuitry contained within the speaker cabinets is shown along with the schematic for circuitry contained within half the amplifier cabinet. The right-channel preamplifier schematic (not shown) is the same as the left-channel preamplifier schematic (shown) except that its part numbers begin with a 100. Thus capacitor C130 and resistor 101 in the right-channel preamplifier correspond to ca-



Front and rear views of preamplifier cabinet.



Schematic of circuitry in speaker cabinet.

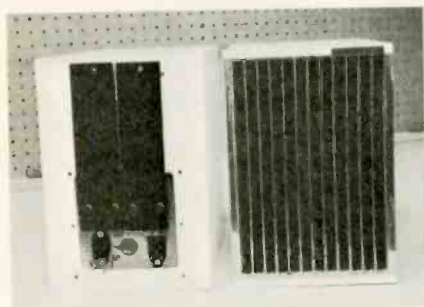


Top and bottom views of preamplifier chassis with wooden cabinet removed.



pacitor C30 and resistor R1 in the left-channel preamplifier. Cable connections on plugs P1, P2 and P3 are attached to cable connections on jacks J1, J2 and J3 respectively. You will also note that some of the electronic symbols differ from those used in this country, but with a little figuring, they can all be identified. All that is missing is the circuitry contained within the signal-correcting integrated circuit (M.F.M.).

When testing the audio system,

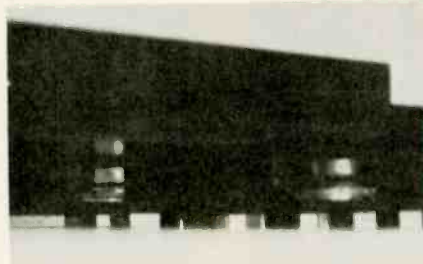


Front and rear views of speaker cabinets.

we did have a problem when initially using the preamplifier's audio input terminals since they are of European design and use five-connector plugs. However, after a quick trip to our local parts distributor, we obtained the correct plug plus some standard RCA-type sockets and soon had a very acceptable adapter. Our second problem resulted from the fact that the system's phonograph input was designed only for magnetic cartridges, while the phonograph than on loan

had a ceramic cartridge with so strong an output signal that it overloaded the phono-input circuitry, producing excessive distortion. Rather than constructing padding circuitry, we instead plugged it into the optional-input terminal and attempted to use the TONE controls for proper frequency equalization. The resulting music was excellent and sounded very crisp and undistorted in the high and mid range, although we had a feeling that the lower bass range was missing—even with recorded organ music. It is our understanding that in Europe there is less interest in bass than in this country.

Using an audio generator as a signal source, we checked the frequency range of the instrument and found that the upper frequency limit may have been 15,000Hz (either the system or our ears ceased to function at higher frequencies, though a much lower frequency



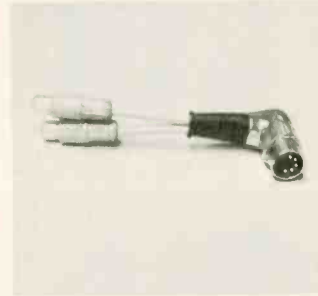
Closer view of transistors in contact with the large heat sinks at the rear of the speaker cabinet.



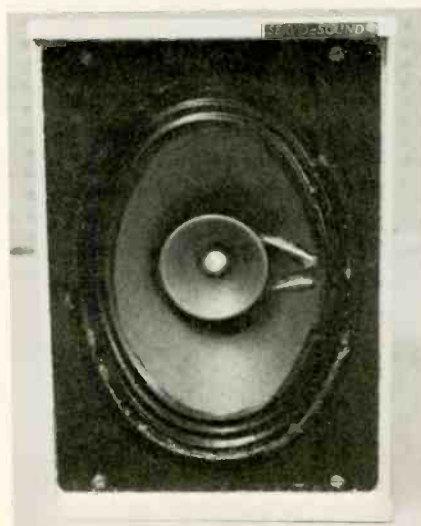
Rear view of preamplifier and speaker cabinets showing cable connections between them.



One of the cables used for connecting the circuitry within the speaker cabinet with that contained within the preamplifier cabinet.



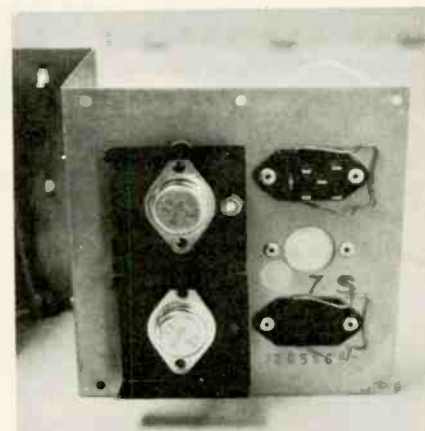
An adaptor made up to convert from a European system of connectors to the system used in this country.



Front view of wooden speaker cabinet with grill removed for access to speaker and electronic circuitry.



The speaker and baffle appear to be made of a single piece of cast white metal. Note the single sheet of sound-absorbing material that is pressed into position between the speaker area and the electronic circuitry.

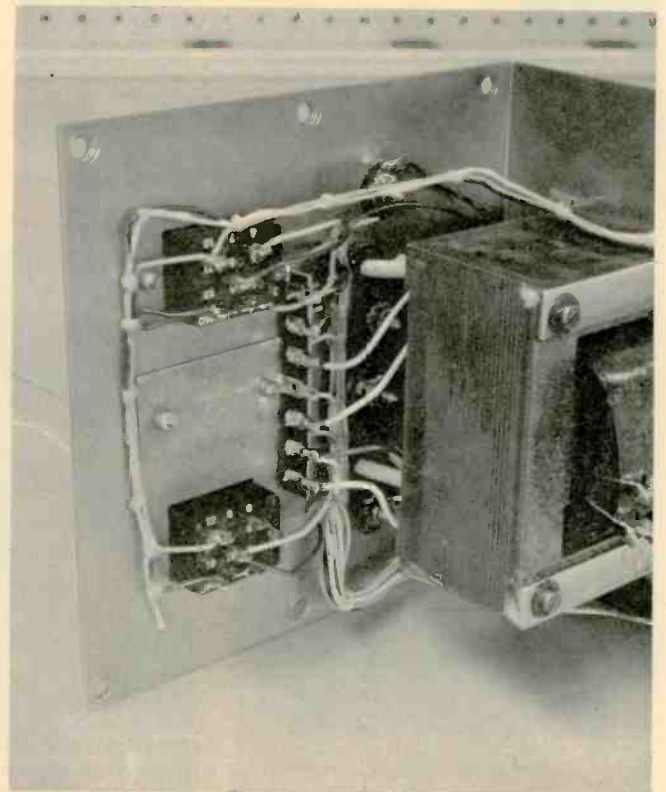
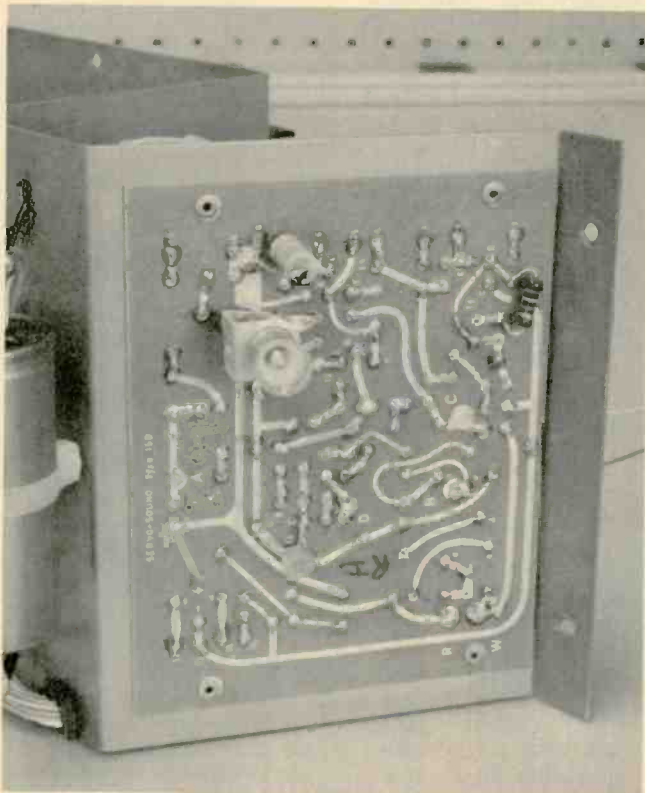
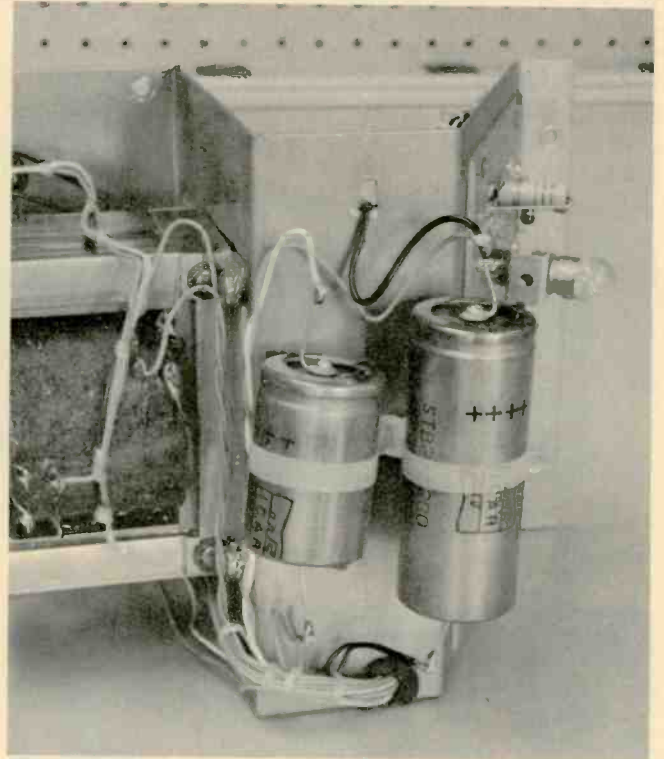
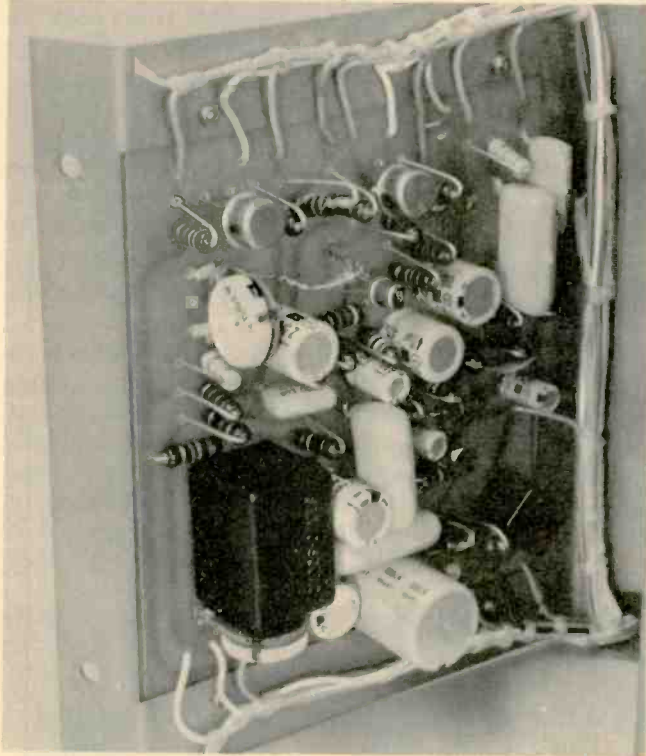


Close-up view of cable connectors. The one at the top right is for use between this speaker cabinet and the preamplifier cabinet, and the other is for use between this speaker cabinet and any additional speaker cabinets that might also be used to handle the same audio channel. The power-output transistors are also shown.

overloading type sound was heard when an excessively strong signal was applied at higher frequencies). At the other end of the audio spectrum, we observed the speaker pulsating at frequencies as low as 1Hz.

However, at any appreciable volume, resonant frequencies appeared to be generated as we applied audio frequencies of 80Hz or less. This is still quite good when you consider the fact that the entire speaker en-

closure, including speaker, air chamber, power amplifier and power supply, measures only 10 $\frac{1}{8}$  in. by 7 in. by 10 $\frac{5}{8}$  in. deep (excluding components external to the rear of the cabinet). ■

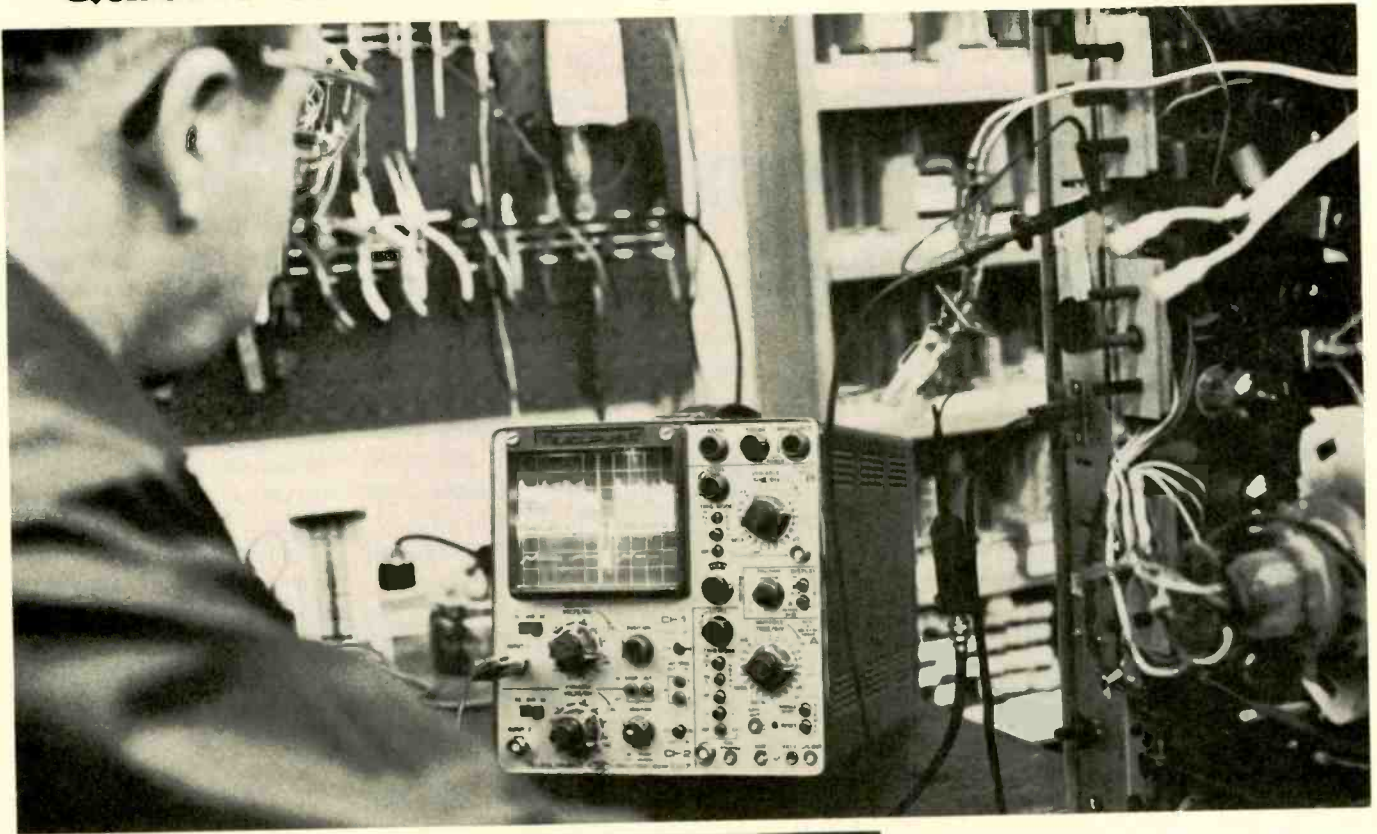


Top and bottom views of the power-supply and power-amplifier circuitry housed in the speaker cabinet.

Additional views of electronic components housed in the speaker cabinet.



# Quick Permanent Repairs with Confidence.



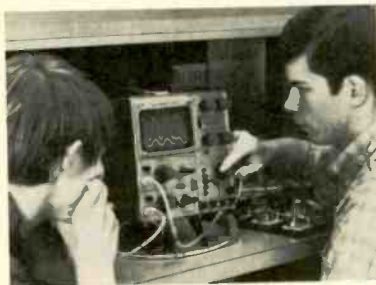
## The D67 ends troubleshooting guesswork in complex TV and audio circuits—at a low price.

TV and audio equipment servicing is outdistancing the capabilities of older test instruments. Also, greater use of electronics in consumer products (pocket calculators, microwave ovens, digital clocks, home intruder alarms, etc.) is opening up new service opportunities. Telequipment offers you the high performance you need in a low-cost scope for this new service business.

The D67 combines dual-trace, delayed sweep, and 25 MHz bandwidth, at a very low price. Non-delayed sweep scopes just can't compete with the D67's delayed sweep measurement flexibility. It allows quick, accurate troubleshooting of IF tuning and color bandpass problems. You can also see fast circuit conditions after relatively long time delays.



If you don't require delayed sweep but need dual trace at 25 MHz, here's another economical, quality scope—the D66. Troubleshooting consumer digital products such as mini-calculators is made easier by using dual trace. Also a "SUM" mode with normal-invert capability makes it possible to look at small signals in the presence of common mode noise—such as power supply hum.



This simple to use, dual trace, 10 MHz D54 gives you low-cost, dependable performance in a wide variety of applications. Like all Telequipment scopes, it is light weight, easy to carry and is backed by Tektronix warranty and reputation for quality. Students shown are testing amplifier circuit by measuring the gain between input and output signals.

Dual-trace waveforms displayed on a bright CRT are essential for servicing TV and high quality audio systems, where time and phase relationships between signals are critical. Whatever the consumer's electronic service problem, 25 MHz is probably all the bandwidth you will need.

Telequipment products are marketed and supported in the U.S. through the Tektronix network of 52 Field Offices and 35 Service Centers. Telequipment prices range from \$245 to \$1495. For a Telequipment catalog, and a reprint of the ET/D review of the D67, write: Tektronix, Inc., Box 500, Beaverton, Oregon 97005



... for more details circle 136 on Reader Service Card

# A Little Psychology Goes a Long Way

by Lambert C. Huneault, CET

With a wave of consumerism sweeping the country, the subject of customer relations should be timely in any business, and certainly in the radio and TV service business in particular

■ Any electronic technician . . . even the veteran with a couple of decades in this business . . . will readily admit that home entertainment equipment is, without a doubt, complex equipment. If the experts consider color-TV sets, tape recorders and stereo receivers as being complex devices, just imagine how the layman . . . the average customer . . . must feel about the hodgepodge of wires, components, circuits, etc. . . . that make up his stereo or TV set!

Precisely because he cannot fathom the complexities of the electronic devices he uses in his

home or automobile, John Q. Public is a little skeptical when repairs are needed; he feels completely at the mercy of the serviceman. Put yourself in his position. . . . If you did not know anything about electronics and had to call in a technician to repair your TV set, would you not feel a little uneasy also? Or, to be more objective, let us say your car or truck breaks down and you have to call a mechanic to the rescue. If the vehicle is taken to a garage, how do you know you can trust that specialist when he tells you the automatic transmission is defective and gives you an estimate

EPLETT'S SERVICE DEPOT			1077 Drouillard Rd. Windsor, Ont. Phone CL 6-9482		B 4394	
FACTORY AUTHORIZED SERVICE RADIO, TELEVISION, HI-FI, TAPE RECORDERS			CHARGE DEALER <input type="checkbox"/>		DATE <i>June 12, 1972</i>	
NAME <i>John Doe</i>			SOLD		TEL. <i>945-8395</i>	
ADDRESS <i>1234 Main St.</i>			<input type="checkbox"/> IN WARRANTY <input type="checkbox"/> OUT		COMPLETED <i>June 12, 1972</i>	
MAKE <i>Brand-X</i>			TROUBLE <i>Screen lights up - no pix, no sound</i>			
MODEL <i>ABC-98</i> SERIAL <i>7654321</i>						
MATERIAL			LABOUR			
QTY	DESCRIPTION	PRICE	DESCRIPTION			PRICE
<i>1</i>	<i>6CG8A OSC./MIXER TUBE</i>	<i>4.90</i>	<i>Service call to house.</i>			
			<i>Checked set; located + replaced defective tube.</i>			<i>9.00</i>
			<i>Readjusted local oscillator on channels 2 and 4.</i>			
			<i>Cleaned safety glass and CRT screen.</i>			
			<i>Adjusted vertical height + linearity and levelled deflection yoke.</i>			
TOTAL MATERIAL		<i>4.90</i>				
TERMS: Cash, upon completion of work. 7% INTEREST charged on past due accounts. On or before the _____ day of _____, I, the undersigned, promise to pay Eplet's Service Depot the sum of \$ _____ for service rendered, re. Invoice No. _____ I further agree that I am responsible for collection charges, should Eplet's Service Depot put my account in collection, due to my failure to pay said account in full on or before the above-mentioned date. Date: _____ Signed: _____			TOTAL TECHNICAL FEES		<i>9.00</i>	
			TOTAL MATERIAL		<i>14.90</i>	
			3% SALES TAX		<i>0.15</i>	
			TOTAL AMOUNT		<i>14.05</i>	
Bert Huneault, R.C.C. Graduate, R.E.T.A. Senior Member			"We Take Pride in Expert Workmanship"			

An example of how to effectively describe services performed when billing a customer.



of over a hundred dollars for the repair work? If you have confidence in that mechanic, garage operator or car dealer, you will trust him and give him the go-ahead; but if you lack confidence in him, you undoubtedly feel skeptical and "at his mercy." Confidence is therefore the big factor here.

How, then, does a technician earn the confidence of his customers? Building up a reputation as a technically competent man is an obvious requisite; for this, he must "know his stuff" and constantly upgrade his knowledge by reading, studying, attending manufacturers' seminars and association meetings. Electronic technology is moving at a phenomenal pace, and one can easily get left behind in this business.

But acquiring customers' confidence goes further than that. The technician must *treat* his customers properly. This does not only mean that he must observe the Golden Rule, but he must also *watch the little things* in his everyday dealings with the public. This is where a little psychology comes in. Fortunately, the type of customer psychology the writer has in mind does not require a university degree . . . only good old-fashioned common sense! Some of the following points may seem elementary, but, in the author's opinion, they are certainly worth repeating . . . many of them frequently!

- Be courteous towards your customers, not only in their home or in your shop, but on the telephone as well. Good telephone habits are particularly important because the first contact with your business is often via the phone, and

first impressions are often lasting impressions.

- Be pleasant and show a little personality. A smile and a cheerful "good morning" does not cost anything, but will often be sufficient to reassure the customer when you enter his home. The writer recalls some customers telling him how they resented the "lifeless" personality of some servicemen they had previously dealt with, and who, in the customers' words, "hid behind the set and did not say a word or explain anything" . . . or "you say hello to them and they are stuck for an answer!" On a service call, the technician obviously cannot afford the time to engage in long, irrelevant conversations, but a few casual remarks . . . even if they are only about the weather . . . will often make the customer feel more at ease. If the serviceman notes an unusual work of art or a beautiful piece of furniture in the home, congratulating the housewife for her good taste can easily convert his image in her mind . . . from a villain's to that of a "good guy." Remember, the little things sometimes count more than we think.

- Listen carefully to the customer's description of the symptoms; it is only common courtesy to begin with, and it shows that you are interested, but lending an attentive ear to his or her complaint is also good advice because in the description of the fault may lie an important clue that can save a lot of troubleshooting time.

- Do not knock the customer's set, because in doing so you may be casting a shadow on his judgment; after all, it was *his* decision to buy that set in the first place! Even if you are con-

vinced the set is a mechanical abortion, as some equipment certainly is, or is a trouble-maker from the word go, your comments are best kept to yourself!

- Do not condemn any brand of equipment, particularly if you are an independent doing dealer service work. For example, if a customer tells you he is thinking of buying a new set and asks you what you think of this brand or that brand, do not tell him to stay away from Brand A, or say that Brand B is no good, even if you feel strongly about it yourself, because there is always the possibility that this customer in the market for a new set might drop in on one of *your* dealers some day. If, in response to the dealer's attempt to sell him Brand A or Brand B, the customer confronts him with your remarks about that brand, your position is jeopardized, vis-a-vis that dealer.

The writer is not suggesting that you lie about the product, but you can get off the hook with a tactful answer, something to the effect that in this business, like in the automotive business, for example, mos. manufacturers occasionally slip up and put out a product "below par" some years but produce good products other years; for this reason you can neither condemn a set or give it your unqualified endorsement just because it is of Brand X.

- Never imply that the serviceman who repaired the set before you did not know what he was doing, because there is always the chance that this serviceman was yourself!

- Use a properly designed service order form. This is a point frequently

neglected by shop owners; yet, it is an area where a little psychology can indeed go a long way. Many technicians use small order pads available commercially from local parts jobbers or office supply stores; most of those order forms have one thing in common: they devote insufficient space for the description of labor charges. If, as is often the case, the form features several lines of space for material but only one line for labor, then the invoice might read, for example: 6CG8A tube \_\_\_\_\_ \$4.90; Service Charge \_\_\_\_\_ \$9.00. This does not convey much information.

Picture the customer returning home from a hard day's work at the plant or office; he is greeted by the little woman saying: "Hi, dear; the TV serviceman came this morning . . . here's the bill." Looking at the invoice, he is likely to exclaim: "Nine dollars labor just for replacing a tube? . . . These TV guys sure have a lot of nerve! . . ." When the bill shows no details, we cannot really blame the customer for feeling that way.

On the other hand, an invoice designed with a little customer psychology in mind, such as the relatively large 8½ by 11-in. order form used quite successfully by the writer while in business prior to entering the educational field, provides the all-important advantage of devoting a large amount of space for comments under "Labor" (details of the service call and/or shop work).

During a routine service call, a technician usually has to perform minor adjustments such as picture centering, focus, size, lin-

*continued on page 49*

## TEST INSTRUMENT REPORT

# RCA'S Model WT-524A Transistor/FET Tester

by Phillip Dahlen

Designed for measuring  
ac beta of transistors and  
transconductance of FETs

■ There are all sorts of techniques for testing and comparing semiconductors. The easiest checks require merely the use of an ohmmeter. If junction resistances are high in one direction (with one polarity of instrument test leads) and low in the other direction, then the semiconductor quite possibly works. Far more refined tests call for the use of a curve tracer, which may be an adaptation of a scope and small filament transformer, along with a few associated components, or even the use of sophisticated instruments costing thousands of dollars.

The above mentioned techniques may supply the average electronic technician with either little or no information, or an extremely large file of data—against which there are no readily available standards of comparison.

If it were practical to have an extremely large book available that listed most semiconductors and their corresponding characteristic curves, then the curve tracer would probably prove to be the most satisfactory method of determining whether or not the transistor under test met the required specifications. Without such data, it is only possible to estimate whether or not the semiconductor under test is in the right "ball

park." Unfortunately when a semiconductor fails, it does not leave behind a record of its characteristic curves and so no standard remains readily available against which to make comparisons when selecting a new semiconductor. Thus, without standard curves against which to make a comparison, the use of curve traces by the average electronic technician becomes restricted to the task of matching available semiconductors—a task for which the curve tracer is ideal.

On the other hand, there are many cross references (in addition to some schematics and the blister packs in which some semiconductors are sold) that do list the ac gain and dc characteristics of most semiconductors according to their code number. Most of this data can be compared directly with the characteristics of the semiconductor under test, as measured on a dynamic transistor/FET tester. (Less-expensive instruments indicating dc gain but not ac gain are unable to supply sufficient data, since most semiconductors are used only for ac signal amplification.)

Using a 6½-in. meter and two plug-in transistor-socket adapters, the instrument described this month is designed for testing all types of

bipolar and FET transistors. According to specifications, the new instrument will not only measure the ac beta of bipolar transistors, including Darlington and dual types, with an accuracy of  $\pm 3\%$ ; it will also measure the transconductance of FETs, including depletion or enhancement types, n- or p-channel types, dual types, and dual-gate types, at  $G_m$  values of up to 100,000 with an accuracy of  $\pm 3\%$ . Zero bias drain current, dc drain current and out-of-circuit gate leakage measurements can reportedly also be made. Operating current levels are said to be adjustable to 30ma for all of these tests.

The instrument is reportedly supplied with complete instructions, two plug-in test adapters—one each for bipolar and FET transistors—as well as a set of clip leads for in-circuit work. The test leads, three-wire power cord and adapters can be stored in the rear of the instrument.

Additional specifications indicate that the instrument is housed in a rugged, die-cast metal case and has a color-coded panel and mirror-scale meter. It is designed to be operated from either 120v or 240v power lines at 50Hz to 60Hz. ■



RCA's Model WT-524A Transistor/FET Tester. For more details circle 900 on the Reader Service card.



# COLORFAX

The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

## ADMIRAL

### Color-TV Chassis K19—Failure of VOLUME Control

Occasional failure of the VOLUME control on the K19 color-TV chassis has been traced to an arc in the 10T10 audio output tube. Damage to the control may be eliminated by adding a 100K, 1/2w resistor between pin 8 of the 10T10 and the wiper of the control (which connects to pin 13 of P101).

## GENERAL ELECTRIC

### Color-TV Chassis MA—Intermittent Modules

The signal interconnect board in early production sets used bare wire leads in certain locations which when improperly dressed could touch connections on the module plugs and cause short circuits. To correct this problem, seat the modules well to assure clearance from wires on the signal interconnect board. Later production uses insulated leads to prevent this problem.

Often merely reseating a module will clear the intermittent. If a replacement module clears the problem, check the original again because it may also work. The reseating corrects for what was originally poor seating or cleans the pin connectors.

### Color-TV Chassis MA—Circuit Breaker Tripping

Tripping can be caused by control misadjustment, allowing the receiver to operate from a few minutes to many hours before tripping.

Adjust Beam Limiter: Rotate the BRIGHTNESS, CONTRAST and BRIGHTNESS LIMIT controls fully clockwise. Rotate the COLOR control fully counterclockwise (CCW). Push the AUTO button or ONE TOUCH button to OFF (unlighted). Ad-

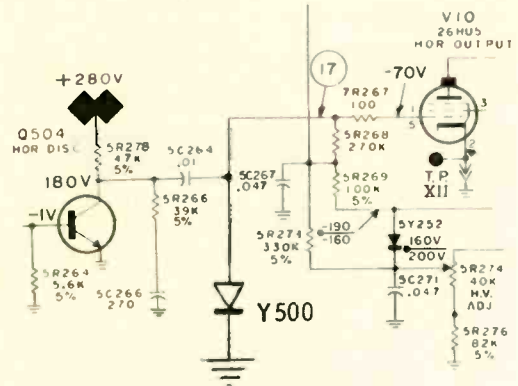
just the BRIGHTNESS LIMIT control, R340, (on video low-level module) to produce a 0.5v measurement across resistor R418 on the RGB module. Measure voltages across

resistors R438 and R458 on the RGB module. Add the three voltages across resistors R418, R438 and R458. The total should be 1.5v or less.

Tripping can also be caused by the horizontal output transistor Q1701 case being grounded. The tripping will be quick in this instance. The mica insulation under the transistor may be reversed or a burr on the transistor or the mounting plate may have punctured the mica and caused the short.

### Color-TV Chassis C1/L1 and C2/L2—Horizontal Discharge Transistor Q504 Failure

After replacement of transistor Q504, add a clamp diode, Y500 (EP57X1), to the copper side of the Sync Cir-

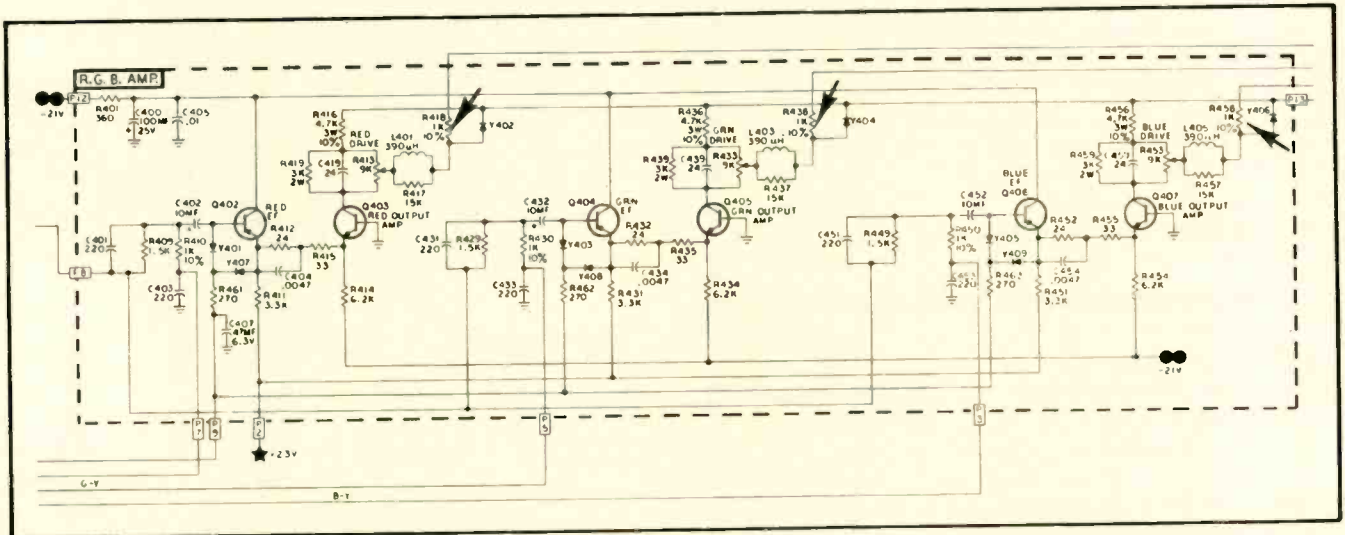


cuit Board as shown in the schematic. The diode is easily added and will protect Q504 from high "turn-on" voltages.

Diode Y500 was incorporated into production sets beginning with Serial Number Code 5S40.

### Color-TV Chassis JA—Colored Raster with or without Video and Sound

Remove from the circuit and check transistors Q600, Q604 and Q606. Also check diodes Y600, Y602, Y604, Y606, Y608 and Y610. Their front-to-back ratio should be at least 3-to-1 in circuit. Visually check resistors R602, R606 and R610. Check resistor R408, located on the power supply board. Replace integrated circuit IC501 with the half circle code on the IC keyed to the number 1 on the circuit board. Ignore the Number 1 on the IC501 socket. Replace all other defective components found above. Inte-



grated circuits and transistors should not be replaced while the TV receiver is ON. The integrated circuits and transistors can be damaged by power-supply surges.





capacitor is very small and its polarity marking is hard to read. This has resulted in some capacitors being installed backward, causing early failure. The proper polarity is negative to ground.

## PSYCHOLOGY...

*continued from page 45*

erity, etc. . . . He might even clean the screen and/or lubricate the tuner at no additional charge if this work entails little additional time. But how can he get credit for this conscientious work, if the customer is presented with a bill that simply reads: "Service Call \_\_\_\_\_ \$9.00?"

If the technician does perform the duties mentioned, regardless of whether he writes it down in detail or not, the service charge is justified in his own mind, but a detailed description of the services rendered or work done,

such as shown in the author's sample invoice, actually plays an important psychological role: it helps to "ease the pain," the customer being made to realize that he is receiving value for his money.

Properly designed invoices can serve as a form of low-cost advertising, improve your image as a TV technician, reflect your professionalism and promote repeat business by fostering more confidence in your services.

In short, it is often the little things that count in business! ■

THE SHORTAGE OF QUALIFIED TECHNICIANS IS REACHING A

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... for more details circle 129 on Reader Service Card

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TE-292

... for more details circle 117 on Reader Service Card

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\*Mail order prices; F.O.B. factory.

TE-293

... for more details circle 118 on Reader Service Card

## TECHNICAL DIGEST

The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

### EMERSON

#### Radio Model 31P86—Repair of Back Cover or Battery Lid

The following is a procedure to be used in repairing either the back cover opening or the battery lid of the Model 31P86 radio. (Remove two screws to take off back cover.)

The only material needed will be some black polystyrene (which will be supplied by Emerson upon request), a tube of adhesive or cement (Eastman 910 or equivalent), a pair of scissors or a paper cutter if available. You will find that the polystyrene will cut very easily.

There will be two different strip sizes. One will be 5/8 in. squared, the other will be 11/16 in. by 3/16 in. How and where they are used is shown in the illustrations.

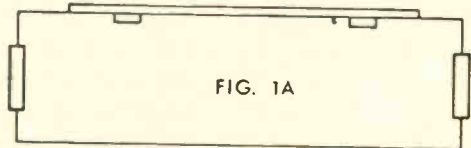


FIG. 1A

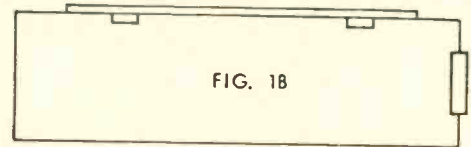


FIG. 1B

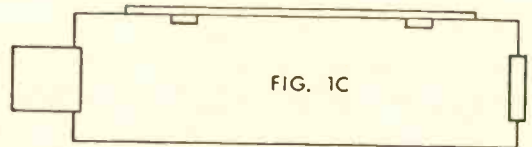


FIG. 1C

#### Opening on Back Cover (Inside of Cover)

Shown in Fig. 1A are the unbroken tips while Fig. 1B shows one side broken off and Fig. 1C shows a placement of the 5/8 in. square of polystyrene cemented in place. For cementing, follow the instructions shown on the tube for applying the liquid. Placing the case on a flat surface, apply pressure with your finger for a period of about one minute so that the polystyrene will adhere to the case. The same instructions apply if both tips are broken.

#### Battery Lid (Inside of Lid)

Shown in Fig. 2A are the unbroken tips while Fig. 2B shows one side broken off and Fig. 2C shows the 5/8 in.

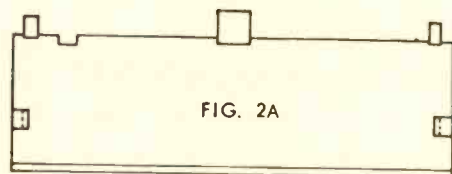
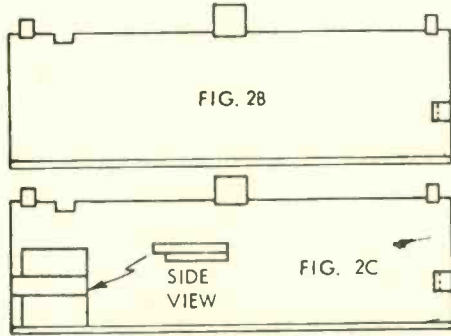


FIG. 2A

polystyrene strip with the 11/16 in. strip centered on top and cemented down. In cementing, be sure to set the 5/8 in. strip 1/16 in. from the edge (Fig. 2C) to allow the other



strip to become flush with the edge. Use the same proce-



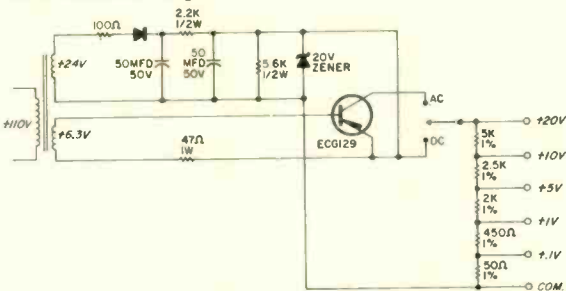
dure for cementing to the lid as used for the back cover.

## SYLVANIA

### How Accurate Is Your Test Equipment?

Modern solid-state products require greater accuracy in test measurements. All equipment should be checked periodically for accuracy on all ranges and be repaired and recalibrated if required.

There are several means readily at hand for checking the accuracy of a VTVM or VOM. The first step in calibrating or checking a VTVM should be to check the 1.5v scale. A fresh flashlight battery will measure very close to 1.55v and may be used to check the meter for full-scale deflection on that range. Some meters, such as Heath-Kit, have a small red dot at the high end of the 1.5v scale to use as a calibration point.



Once the 1.5v scale is calibrated, check all the resistance scales, bearing in mind the tolerance of the resistors used to make the test, 1 percent or 5 percent are best. Choose values that are about 50 to 75 percent of the full-scale reading for best results.

Most meters use the same multiplier resistors for both voltage and resistance, so if your resistance scales are accurate, the dc voltage scales will also be accurate.

To check the ac scales, set the meter to the 150v ac range and cross-check ac line voltage against another meter. Again, the same multipliers are used for ac as well as dc.

Periodic checks should also be made on your scope, since accurate P-to-P voltage measurements are a must in some circuits. A scope can be cross-checked against a good VTVM, bearing in mind that the VTVM is most accurate on pure sine waves. Multiply the rms reading on the meter by 2.28 to obtain the P-to-P reading as displayed on your scope.

An AM Signal Generator may be checked by Zero-Beating harmonics, sub-harmonics and fundamental frequencies against WWV, the Bureau of Standards time signals. You may use either a communications receiver or any SW receiver, capable of tuning 10MHz.

The lower ranges of the generator may be checked by beating against standard broadcast stations of known frequency, using any AM radio.

A very simple voltage calibrator that will provide both ac and dc output is shown in the illustration.

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## NEWS OF THE INDUSTRY...

*continued from page 16*

### Electronic Technicians Review Serviceability of Advance Designs

Recently a team of Certified Electronic Technicians of the Virginia Electronics Assn. were invited to Portsmouth, Va., to review several advance chassis designs and offer their opinions and make suggestions regarding the service-



Manager of Product Service, W. H. Meyer (left) looks on as Walter Cooke, CET; Cobb Laine; Frank Blount, CET; and John McPherson, CET, examine a new monochrome chassis for serviceability.

ability features (or nonfeatures, if they found that to be the case) included in future GE TV products.

General Electric's Product Service Dept. holds serviceability reviews regularly as part of its program to make certain that every General Electric TV set is designed with ease of service in mind.

In the past such reviews have contributed to General Electric Television Receiver Department's earning a Serviceability Design award from the National Electronic Associations, Inc., covering three solid-state chassis.

## 1974 TV SETS...

*continued from page 38*

of the new 19-in. models will use 27kv on the picture-tube anode. This is made possible by using glass having a higher lead content, which is said to prevent the possibility of X-radiation outside the TV set.

In the console line, the T989 chassis will be used exclusively in 14 models. Six of these chassis will be used in remote-control units.

A new Tune-to-Light feature is available on seven 25-in. console models, and the six-button remote control operates the ON/OFF, VOLUME, MUTE and channel selection. As each channel is tuned, the channel number is displayed in bright, large digital numbers for instant identification. A few seconds after channel selection, the digital channel light indicator diminishes to an eye-pleasing viewing level.

Although all of the circuits are solid-state, the chassis maintains the configuration of the tube-type chassis and the service adjustment controls remain essentially the same.

The majority of the circuitry is located on four cir-

*continued on page 58*



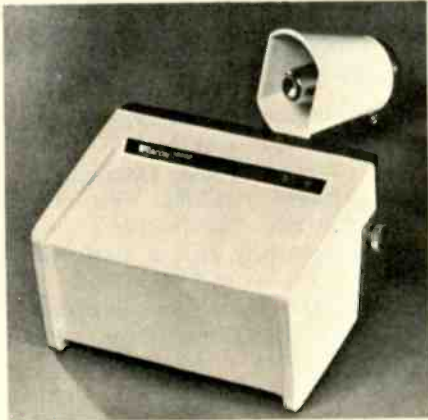
## NEW PRODUCTS

For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly.

### MOTION DETECTOR/ALARM SYSTEM 703

Covers a 30° angle over 0 to 100 ft range

A complete alarm system is designed with reportedly the ability to detect moving intruders at a 100 ft range. For many applications, the Model R4 Microwave Intrusion System can provide protection with no added equipment as it detects motion over a large area. Local alarm signals are provided with a distinctive yodel type electronic siren that may be heard a block away. In addition, the unit provides means for connecting other



detectors from doors, windows, floor mats, fire detector and panic switches to the same alarm. Alarm relay outputs are available to connect it to telephone dialers, direct-wire alarms and other audible signals. The 10.525GHz (FCC certified) microwave motion detection system reportedly covers a 30° angle over ranges adjustable from 0 to 100 ft. Moving intruders are detected with sophisticated solid-state digital circuits that are designed to eliminate false alarms due to random vibrations, air motion, telephone bells, etc. It can be powered from 115v ac or can be switched to 12v battery for emergencies. Mountain West Alarm Supply Co.

### ERRATA

The wireless FM microphone, Model WM-10, manufactured by EV•Game and described in our August NEW AND NOTEWORTHY, is *much* lighter than reported, weighing only 2½ oz rather than 2½ lb as had been erroneously indicated.

## SEMICONDUCTORS 704

Cross-reference guide on package

The new line of WEP solid-state semiconductor components are featured with informative packaging. All packs are cross-referenced to major lines on the face of the package. The WEP series, which consists of some 200 numbers, will reportedly replace up to 1000 numbers in other lines. The uniform, pre-priced and color-coded packs also contain full specifications, basing diagram with symbol and ratings on the reverse side. Up-to-date cross-reference material is available on call from the manufacturer. The line is fully warranted and off-the-shelf delivery is promised by the company. Workman Electronic Products Inc.



### DIGITAL MULTIMETER 705

Entire instrument so small it fits easily in your hand

The manufacturer is so proud of this exciting new instrument that one of its men was sent to personally demonstrate it in our electronics lab. Operating off self-contained rechargeable batteries, the instrument has but three controls—the POWER SWITCH, MODE switch (ac volts, dc volts, or resistance) and a switch that changes the digital readout from right-side-up to upside-down for easy viewing, whatever way you prefer to hold the instrument. All scaling is automatic and in terms of volts or kilohms, the decimal point moving to indicate the magnitude of the measurement observed. All dynamic functions are performed within a single integrated circuit. Specifications indicate that ac and dc voltages from .1000v full scale to 500v are read with an accuracy of ±(0.7% of reading +0.2% of range), while resistance ranges are from 1 kilohm full scale (1Ω resolution) through 10 meg with an accuracy of ±(1.5% of reading +0.2% of range), a row of dashes indicating over-range conditions. The entire instrument measures 6½ in. long by 1½ in. wide and weighs 7 oz with batteries. (More details will be offered in a future article.) Hewlett-Packard.



## DISCOUNT PRICES

### FLYBACK TRANSFORMERS

RCA—143536-501	\$7.95 Each
RCA—143537-501	\$7.95 Each
EMERSON—738229 A	\$6.95 Each
EMERSON—738223 A	\$6.95 Each
Fly-Equiv. Fly 277-H0601C	\$7.95 Each

ZENITH VOLT. TRIP.—212-109	\$5.95 Each
GE-IC3-ZEN. 212-37	\$2.95 Each
Zen-221-45 Color Demod.	\$2.95 Each
Zen. B/W Yoke-95-2974	\$6.95 Each

20 Assorted Mallory Controls	\$2.00
6—10 Ohm Centering Contr.	\$1.19
6—1 Meg. Vol. Contr. On/Off Sw.	\$1.29
10 Assorted IF Cans	\$1.00
50 Assorted Wire Wound Res.	\$2.98
100 Asst'd Bypass Cond.	\$4.98

Philips Auto Stereo Changer With Base-Cart.—Pushbutton	\$22.95 Each
---	--------------

### YOKES—COLOR—YOKES

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Motorola 24D68592B-01	\$5.95 Each
SILVERTONE—80-56-4G	\$4.95 Each
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MAGNAVOX 361348	\$5.95 Each
MAGNAVOX 361380	\$5.95 Each
MAGNAVOX 361395	\$5.95 Each

### RCA COLOR CRYSTALS

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BLUE LAT. MAG./Purity Rings	2 for \$2.98

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25 Assorted Cond. Trans. Sets	\$4.95
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500 Mfd.—75 Volts Axial	3 for \$1.29
20 Mfd.—500 V. Axial	6 for \$2.19
16 Mfd.—450 Volts Axial	4 for \$1.19
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OTHER MODELS  
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VM-50K User Net: \$50.25 VM-10K User Net: \$21.95  
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### Mini Vacuum Cleaner



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54 | ELECTRONIC TECHNICIAN/DEALER, OCTOBER 1973

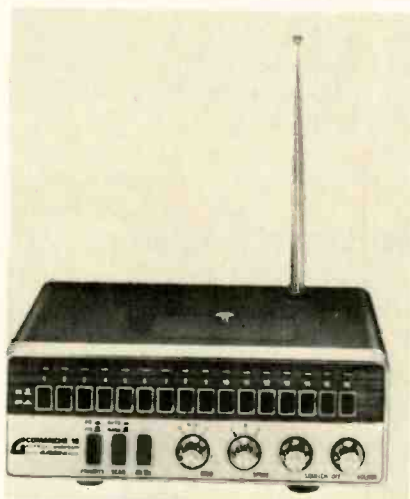
## DEALER SHOWCASE

For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly.

### VHF/FM SCANNER MONITOR

Provides 16 channels with **706**  
manual or automatic scanning

The Comanche 16 VHF/FM Scanner Monitor is designed for 16 channel operation with the capability of operating on VHF high and low band with bypass switches. Other features include a priority channel, manual or automatic scanning, and scan-speed selector. The frequency range is re-



portedly 144-170MHz on high band and 33-47MHz on low band. Specifications indicate a maximum channel separation of 10MHz on high band and 6MHz on low band with a sensitivity of  $0.5\mu\text{v}$  for 12dB SINAD. The unit is reportedly all solid-state, employing printed circuitry with two-pole crystal-lattice filter and ceramic-lattice filter. The unit measures 9 in. deep by  $7\frac{1}{2}$  in. wide by  $2\frac{1}{2}$  in. high and weighs  $6\frac{1}{2}$  lb. Pearce-Simpson.

### FM TWO-WAY RADIO **707**

With rugged steel  
for the roughest service

The Ultracom 507 is said to be a compact, self-contained, 25w-output,



low-band VHF, FM two-way radio with contemporary styling to comple-

ment any decor. Its rugged steel case reportedly offers extra protection in even the roughest service. The controls are recessed for safety, and located on the side of the front panel normally closest to the operator. The unit is available with an optional noise blanker, and is reportedly the only moderate to low cost land mobile two-way radio with this range extending option. The noise blanker is actually designed to turn the radio OFF for the duration of each noise pulse, resulting in a quieter, more readable signal. E. F. Johnson Co.

### CB MOBILE RADIO **708**

Compact and  
weighs only 4 lb

A mid-priced AM 23-channel Citizens-Band transceiver, known as the



Cortez, reportedly utilizes double-conversion design and the SBE "Super Shape" filter to provide excellent adjacent channel rejection with minimum cross talk. The receiver's sensitivity is reportedly  $1\mu\text{v}$  at 10dB with receiver selectivity at 60dB at  $\pm 20\text{kHz}$ . The transceiver will operate with either positive or negative ground vehicles. Other features include switchable noise limiter, plug-in microphone, PA capability and external speaker strength in S units as well as carrier power. Linear Systems Inc.

### COLOR-TV CONSOLE **709**

Chassis employs five  
plug-in modular circuit boards

A new color-TV console, Model



6157, called the "Casino" is said to have major features that include

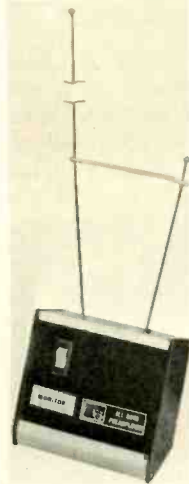


acent channel rejection with minimum cross talk. The receiver's sensitivity is reportedly  $1\mu\text{v}$  at 10dB with receiver selectivity at 60dB at  $\pm 20\text{kHz}$ . The transceiver will operate with either positive or negative ground vehicles. Other features include switchable noise limiter, plug-in microphone, PA capability and external speaker strength in S units as well as carrier power. Linear Systems Inc.

**MONITOR PREAMPLIFIER 710**

*Boosts signal by 16dB*

A compact, new preamplifier, Model MON-50, is designed for tri-band scanning receivers employing two self-contained indoor antennas. The device reportedly requires no wiring changes in the receiver and connects through the monitor's antenna jack. It utilizes house current. The device is said to be especially suitable for apartment applications and other installations where outside antennas are not practical, reportedly boosting the incoming received signal strength a minimum of 16dB. The case is aluminum with leatherette end panels, and measures 5 in. by 7 in. by 3 1/2 in. Ascom Electronic Products.



**SMOKE DETECTOR 711**

*Intended for residential use*

An early warning fire and smoke detector, Model FRU-1, the Pyro-Guardion, is intended for residential use is designed. It contains one pair of



leads for interconnecting up to six units for the purpose of simultaneous alarm (when one annunciates, all annunciates). A single operating alternate version, the FRU-1L, is supplied complete with an 8 ft. household line cord

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<p>UNRETOUCHED PHOTO</p>	<p><b>THE EXACT REPLACEMENT</b></p> <p><b>EV5344</b> In every way a perfect match — same shape, size, color and quality. Installs easily in old bracket. Accepts original needle.</p>
<p>UNRETOUCHED PHOTO</p>	<p><b>THE SUBSTITUTE</b></p> <p><b>ASTATIC 612</b> Requires replacing original bracket. Cartridge shape and needle are different. Will not accept original needle.</p> <p>Tools you may need for a substitute</p>

Needle for needle, cartridge for cartridge and pin for pin you can't beat an Electro-Voice. The fact is, when you specify Electro-Voice, you save time and effort. You don't need special tools or parts. There's no unusual handling or installation. The result is that you have the best chance to maximize cartridge profits and customer satisfaction with EV•Game.

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## DEALER SHOWCASE . . .

*continued from page 55*

for simple "plug-in" homeowner installation. The heart of the unit, which is powered from a 120v ac, 60Hz electrical supply, is an ionization detector that alarms to the invisible products of combustion given off by incipient fires. The audible alarm, built into each unit, is a high-frequency signal. The detector measures 6 in. long, 4 in. wide and 2 in. deep and is designed for surface mounting. Pyrotronics.

### SMOKE/GAS ALARM 712

*Based on N-type gas molecule detection principle*

A highly sensitive warning smoke and gas detector is based on a new solid-state N-type gas molecule detection principle. This detector will reportedly warn of the presence of less than 2 parts in ten million of certain



toxic gases. It will detect within seconds and sound a loud alarm if minute quantities of carbon monoxide, smoke, cooking gas, gasoline, solvents, alcohol and other gases are present in the air. The unit can sense products of spontaneous combustion before a resulting fire and is far more sensitive than a human or animal nose. The Smoke-Chek plugs into any standard 115v outlet and reportedly requires no special installation or adjustments. Delcor Industries.

### TAPE DECK 713

*Features automatic reverse playback*

A new solenoid-operated, two-speed, reel-to-reel tape deck features three GX glass and crystal heads, a Dolby noise reduction system and a unique automatic reverse playback system. The Model GX-285D is a four-track, two-channel stereo/mono system and has three motors—a servo-controlled capstan motor and two outer rotor motors. The unit's controls are solenoid-operated. Another feature of the tape deck is an automatic reverse



playback system. When the reverse mode is affected, the pinch wheel automatically separates from the capstan



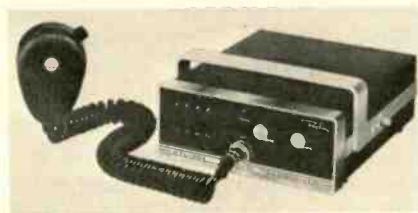
until the selected tape speed is reached. The unit also reportedly features sound-on-sound, sound mixing and sound with sound, mike and line mixing, universal voltage control, tape selector switch for standard and low-noise high-output tape and four-digit tape counter. It is equipped with tape and sound monitor switches to facilitate dual monitoring for instant quality checks to assure professional recording. AKAI America Ltd.

## TWO-WAY RADIO

714

*Compact design permits dash mounting in the smallest cars*

Introduced is a four-channel transceiver serving the low band business radio spectrum, 29-50MHz, with 30w of power output. The Model BTL-304, two-way radio features solid-state cir-



cuitry, enabling the compact package design, which measures 2 5/8 in. by 6 1/2 in. by 9 1/2 in. and weighs 6 1/2 lb. The radio's small size permits easy dash mounting in the smallest cars and trucks without sacrifice of passenger comfort. Future BTL series units will be available with tone decoding receivers and tone encoding generators to further appeal to these public service agencies. The .35µv receiver reportedly has selectivity rated at 6dB ±7.5kHz 70dB ±15kHz and delivers an audio output of 5w. The double conversion IF system rates 10.7MHz to 455kHz. A high impedance plug-in ceramic mike is included in the price of the unit as is a dash mounting bracket. Regency Electronics, Inc.

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## TECHNICAL LITERATURE

### Resistors

An 8-page Short Form Resistor catalog, C-509, contains 5980 items with 616 different resistance values (from 0.1Ω to 250k) and 15w ratings (from 1 to 120w). The catalog also has basic descriptions and physical sizes, providing the data needed for fast, easy selection of resistors and complete listings of the company's family of wire-wound resistors. Sprague Electric Co., 65 Marshall St., North Adams, Mass. 01247.

### Security Project Book

Compiled and written for the hobbyist-experimenter, the book is devoted entirely to the topics of sensors, alarms and detectors primarily for home and auto use. Beginning with basic alarm theory, the manual contains illustrated construction and installation techniques for 11 safety systems. Each project includes a brief description of the systems function, a

schematic diagram, suggested applications and a complete parts list. Also included are assembly hints and a photograph of the finished product. The manual retails for \$1.25. Motorola Semiconductor Products Inc., 5005 East McDowell Rd., Phoenix, Ariz. 85008.

### Heat Gun

A 4-page bulletin, F-302, covers the company's new Mark II lightweight portable electric heat guns. The line features nine models in four heat ranges from 200°F to 1000°F. In addition to specifications and dimensions, the bulletin includes a comprehensive listing of suggested applications for shrinking, drying, softening, thawing and curing. Eddy Products Corp., 15255 Watertown Plank Road, Elm Grove, Wisc. 53122.

### Recorder Care

A totally new, comprehensive 32-page publication published expressly for users of reel-to-reel eight-track cartridge and cassette recorders and players, illustrates how regular maintenance of recording equipment en-

ures continued optimum performance and longest possible recorder life. It provides detailed information of the principles of magnetic recording, magnetic heads and important maintenance operations. The text is well illustrated with photographs, charts and line drawings and includes a complete program for machine care. Nortronics Co., Inc., Recorder Care Div., 8101 Tenth Ave. North, Minneapolis, Minn. 55427.

### Panel Knobs

A pair of catalogs (PK-374 and K-375) describe a new family of plastic molded and anodized machined aluminum knobs with illustrations, dimensions and volume pricing. This group is identified as the "Lexington" Series. Alco Electronic Products, Inc., 1551 Osgood St., North Andover, Mass. 01845.

### Tuner Parts and Replacements

An 80-page tuner Parts and Replacement Guide Catalog, No. 3, is now available. This up to date edition will help the reader to find the tuner problems and replacement part quick-

## 1974 TV SETS...

*continued from page 52*

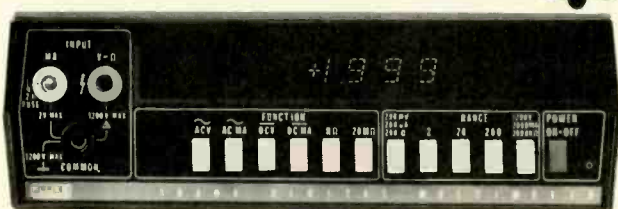
cuit panels which plug into the main chassis pan, and the circuit modules located on these panels are provided with plug-in sockets for easy removal.

Two tuner configurations are used with the T989 chassis. One is the familiar FET VHF tuner and a VHF tuner with detent and drum-type digital readout for each UHF channel. The other configuration uses a VHF tuner with 21 detents, nine of which are used for UHF channels. These nine positions incorporate individual potentiometers which couple a dc tuning voltage to a varactor UHF tuner. The other 12 detented positions are used for the normal VHF channels. The 21 detent tuner is used with remote control consoles and is motorized.

This chassis also uses what is commonly referred to as the "RGB System" in which all matrixing of the luminance signals—R—Y, B—Y and G—Y—is accomplished prior to driving the picture tube control elements, eliminating the luminance chain.

The schematic for the T989 chassis can be found in this month's Tekfax Schematic No. 1492.

The monochrome TV-set line will contain 20 models in screen sizes of 7 to 22 in. Of these models, 18 will contain chassis introduced in previous years. Only one new chassis has been added to the line, which is the T984 used with the 16-in. picture tube. A three hour timer has been added to the T960 chassis to allow automatic shutoff. ■



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Now you can get a high performance Model 8000A Digital V.O.M. from Fluke, America's foremost maker of quality digital multimeters, especially designed for TV, radio, stereo and audio service. No other digital V.O.M. gives you the resistance range to check breakers and switches, the high resolution voltage to look at emitter base and other transistor voltages, excellent ac accuracy and full accuracy with a 30 second warm-up.

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ly. A replacement guide for antenna coils and shafts is also provided. This colorful catalog and price list is available for one dollar. PTS Electronics, Inc., P.O. Box 272, Bloomington, Ind. 47401.

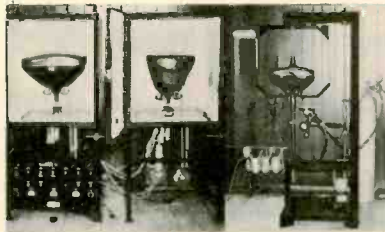
### Electronic Components

A 64-page general catalog published with an expanded index, makes it easier for a buyer to locate the almost 11,000 products described. Among these manufacturer's products are alkaline and mercury batteries, capacitors, controls, recording tape, resistors, security systems, semiconductors, switches, timers, and many other electronic components for consumer, replacement and industrial use. The catalog is available from authorized Mallory distributors.

### Speakers

A new 8-page speaker catalog describes a complete line of speakers that is said to range from quality hi-fidelity stereo speakers to tough, heavy duty public-address speakers. CTS Corp., 5665 No. 8th St., Paducah, Ky. 42001.

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First in the race. Raytheon put together the car. You drove it to top money in the big '72 season. It's a money-making team that started with your switch to Raytheon, the largest independent tube supplier. We know the competition is rough. As an independent serviceman, you can't waste time and money on call backs or pit stops. So, Raytheon builds to beat the competition. You drive hard for first place. And we're going for the trophy again this year. Together.



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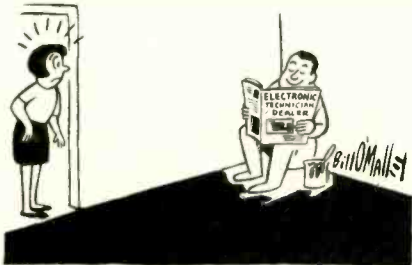
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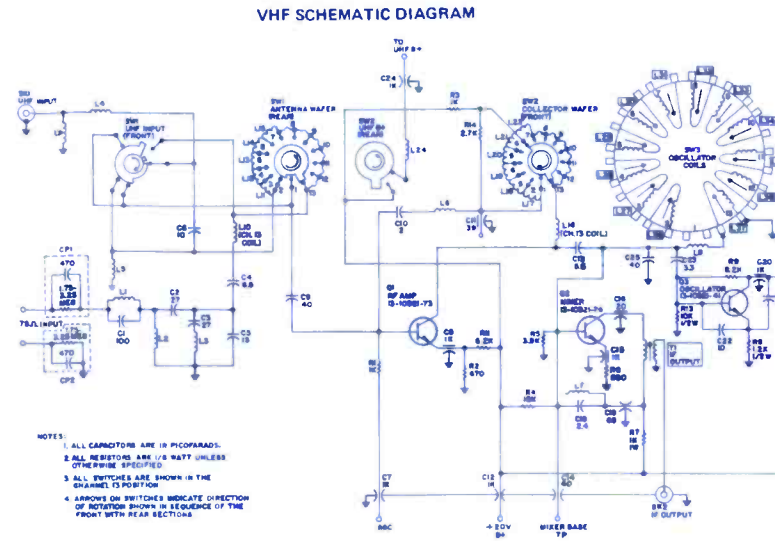


"My husband likes to tinker."



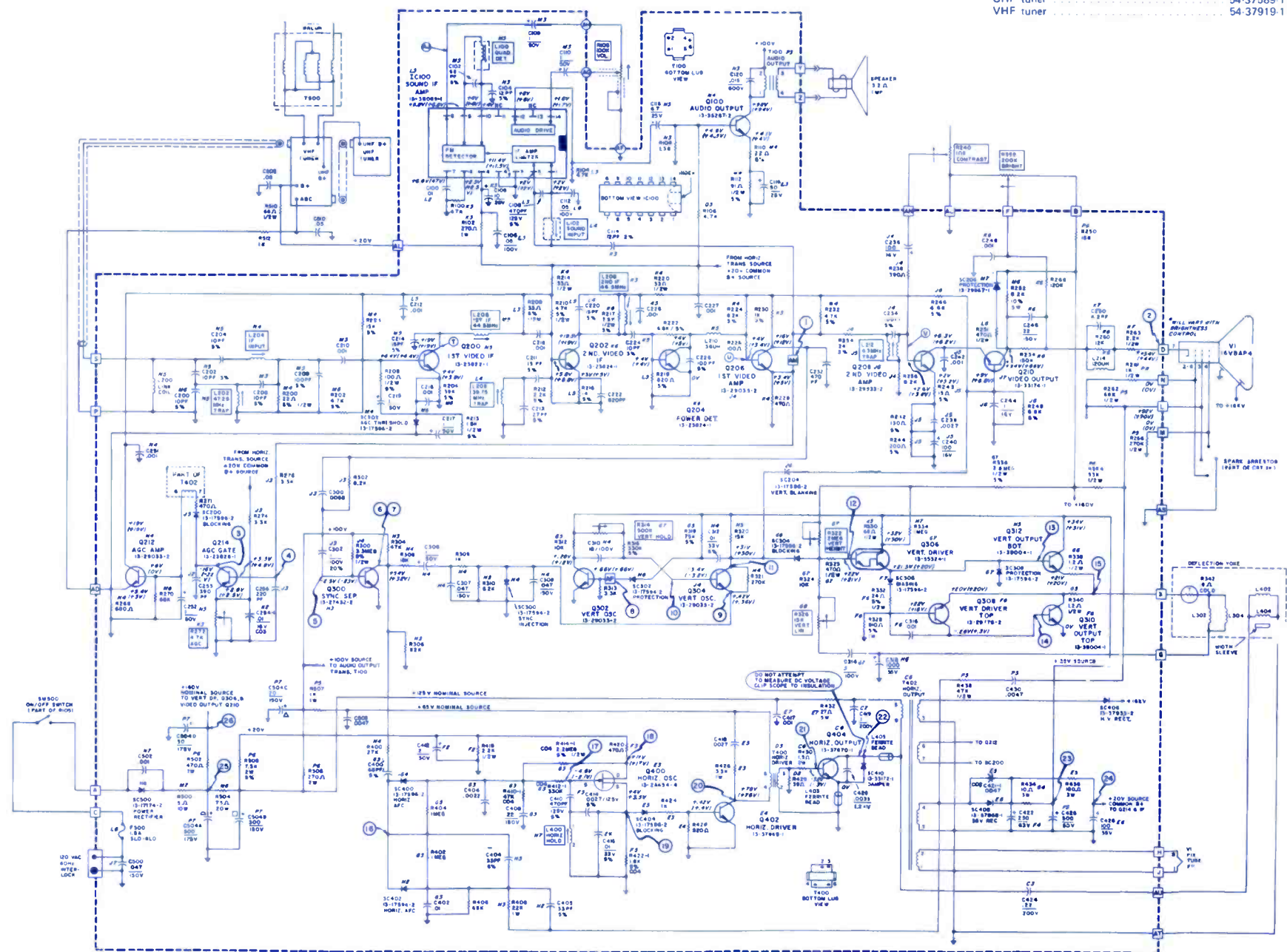
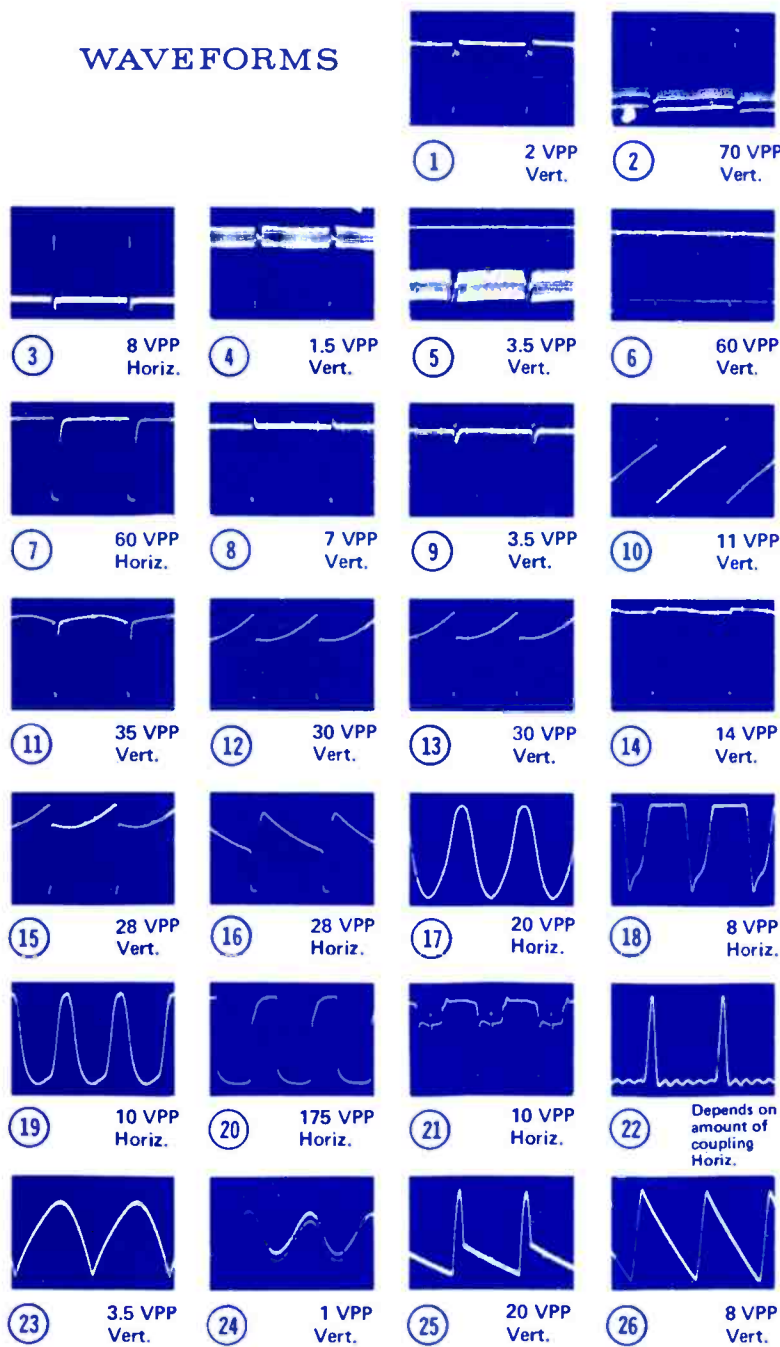
GROUP  
**254**

	SCHEMATIC NO.	SCHEMATIC NO.
AIRLINE TV Models GAI-13133C, D	1494	SYLVANIA TV Chassis A16-1 1490
GENERAL ELECTRIC Color-TV Chassis 10QA	1491	ZENITH Color-TV Chassis 25DC56 1493
MAGNAVOX Color-TV Chassis T989	1492	

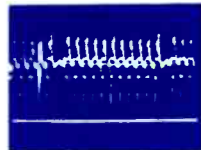


SYMBOL	DESCRIPTION	SYLVANIA PART NO.
C504-4	section electro	41-37861-1
A-	500/175v	
B-	300/150v	
C-	20/150v	
D-	30/175v	
R504-75	20w	36-92898-68
L100	quad detect	50-33195-1
L102	sound input	50-35989-1
L212	4.5MHz trap	50-16238-5
L400	horiz hold	50-33955-2
L404	horiz coil	part of yoke
T100	audio output	56-37872-1
T402	horiz output	50-37884-1
R105	100K volume	37-35105-10
R240	10K contrast	37-27242-52
R258	200K brite	37-27242-51
R272	4.7K AGC	37-14576-13
R314	500K vert hold	37-33036-14
R322	2M vert height	part of R314
R326	15K vert lin	part of R314
F500	fuse 1.5a slo blo	29-37730-3
1C100	integ sound 1F a	15-35059-1
	UHF tuner	54-37589-1
	VHF tuner	54-37919-1

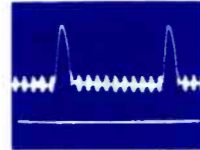
**WAVEFORMS**



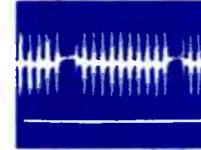




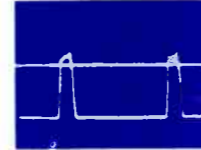
1/2 Horiz Rate 1.25 VPP Q501 Collector



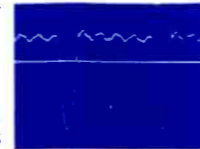
1/2 Horiz Rate 2.0 VPP Q503 Emitter Sets with R568 only



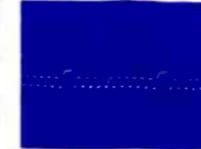
1/2 Horiz Rate 1.0 VPP Q503 Collector Varies with Color control



1/2 Horiz Rate 10 VPP Q504 Base



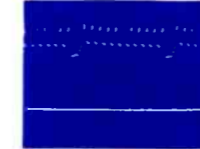
1/2 Horiz Rate 11 VPP IC101 Pin 5



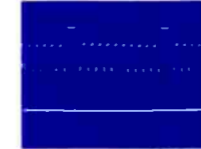
1/2 Horiz Rate 1 VPP IC101 Pin 10



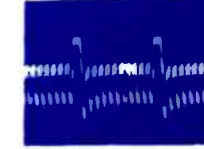
1/2 Horiz Rate 3 VPP Q105 Emitter



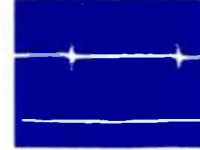
1/2 Horiz Rate 1.25 VPP Q104 Emitter



1/2 Horiz Rate Q104 Collector



1/2 Horiz Rate 1.5 VPP Q106 Collector



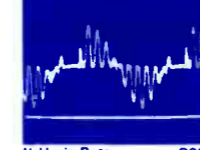
1/2 Horiz Rate 4 VPP Q504 Collector



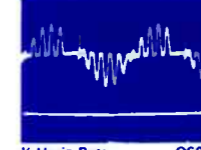
1/2 Horiz Rate 0.3 VPP Q505 Emitter



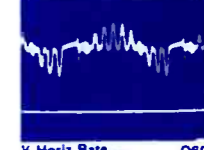
1/2 Horiz Rate 7 VPP T502 Pin 3



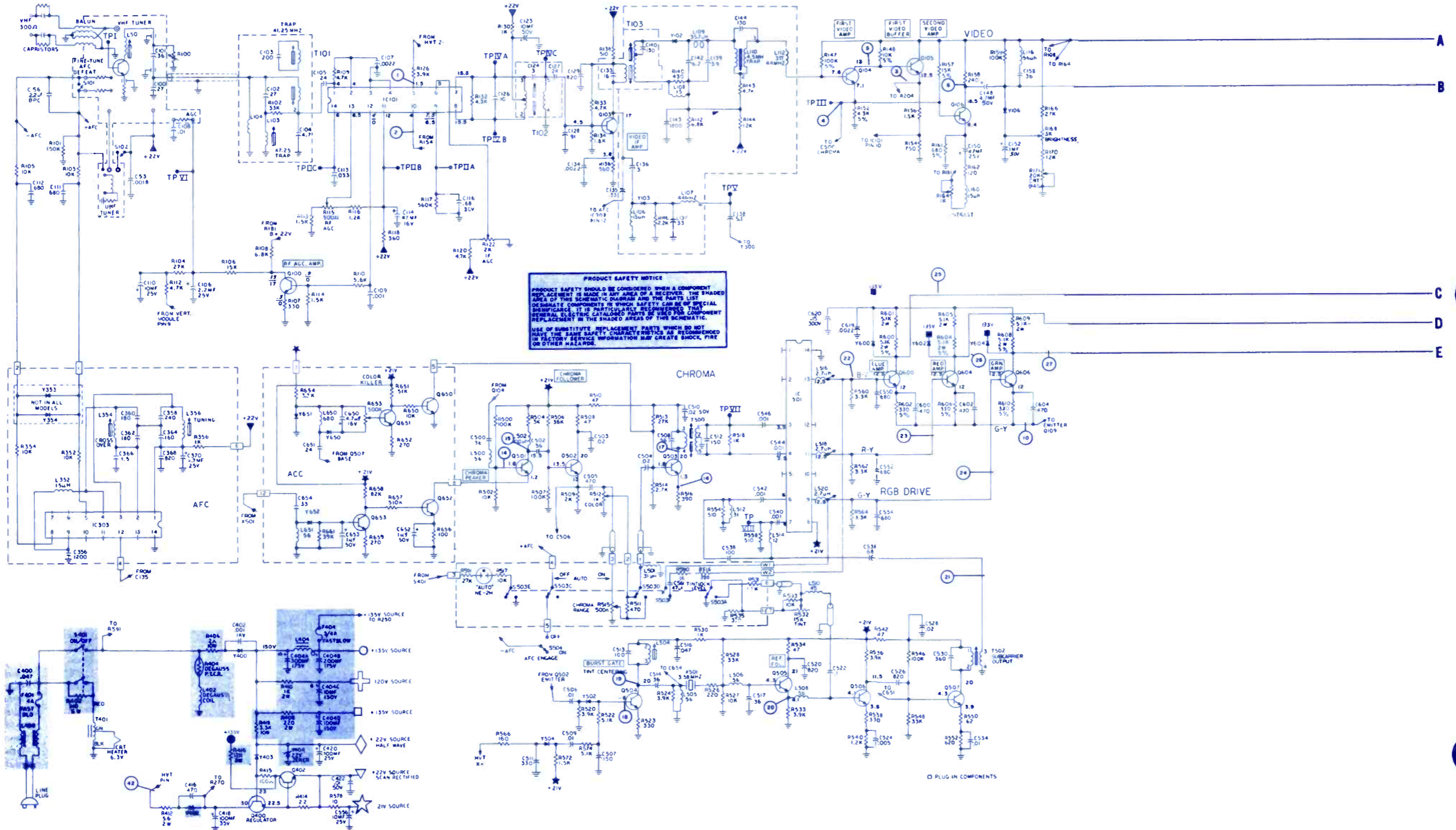
1/2 Horiz Rate 4 VPP Q600 Base



1/2 Horiz Rate 6 VPP Q604 Base



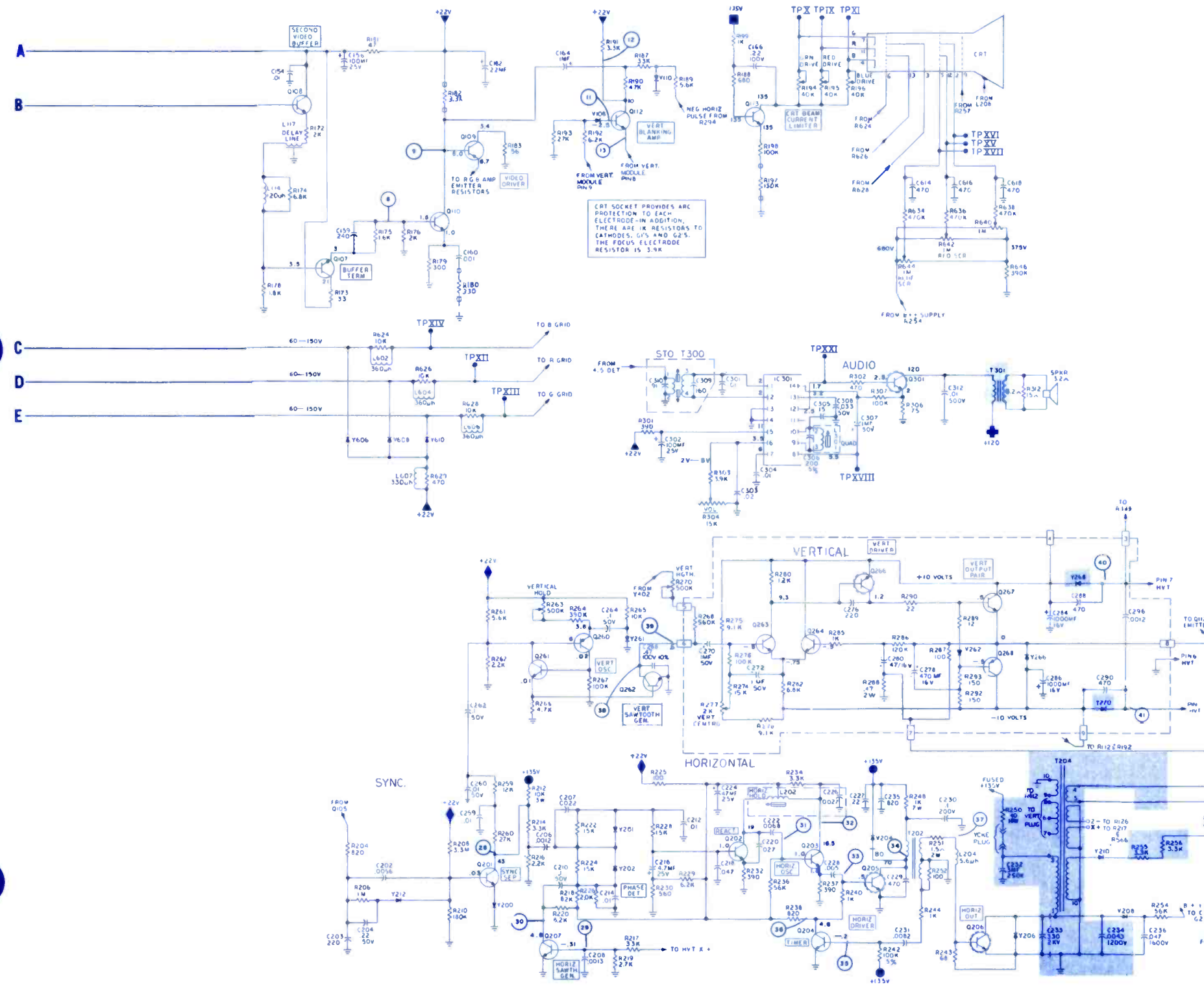
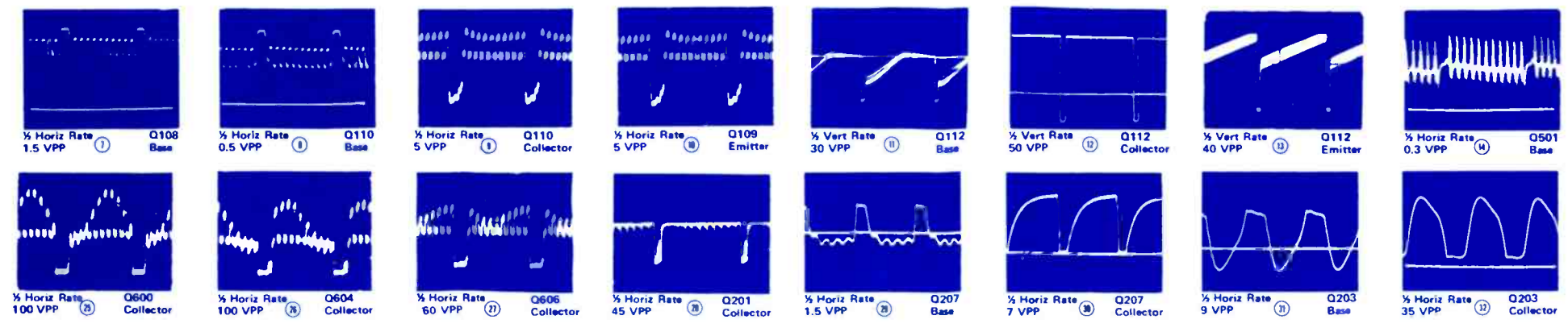
1/2 Horiz Rate 2 VPP Q606 Base



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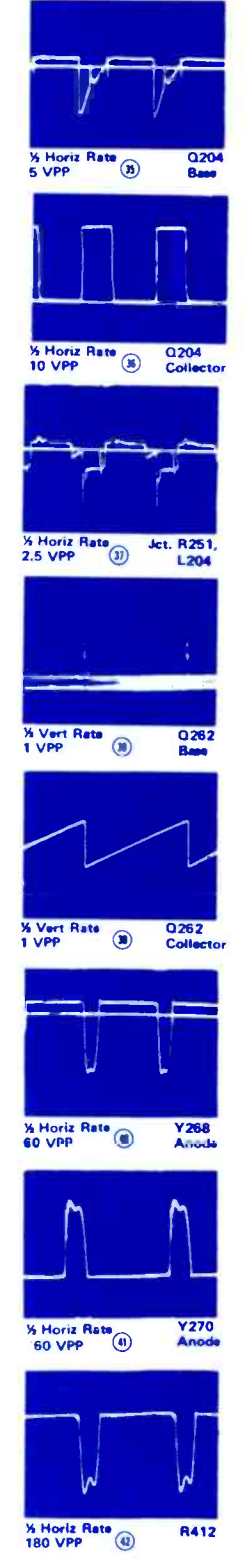


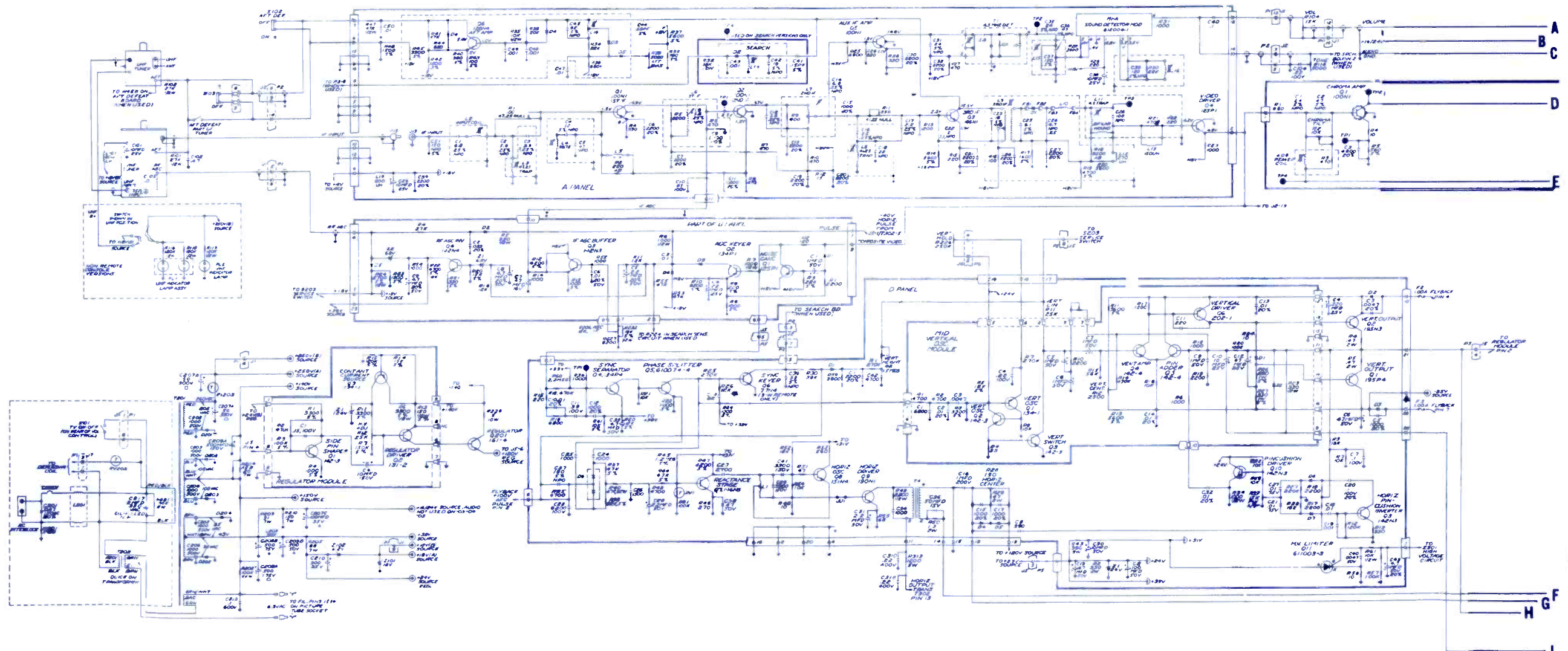
**GENERAL ELECTRIC  
Color-TV Chassis 100A**



SYMBOL	DESCRIPTION	GENERAL ELECTRIC PART NO.
R115	RF AGC, 500Ω, 20%	EP49X92
	dual control	EP49X94
R122	IF AGC, 2K	
R196	blue drive, 40K	
R171	(CRT bias) 20K	EP49X96
	dual control	EP49X97
R194	green drive, 40K	
R195	red drive, 40K	
R258	focus, 15M, 20%	EP49X91
R515	chroma range, 500Ω	EP49X159
R653	color killer, 500K	ES49X535
L110	coil, 4.5 trap asm. w/core	EP61X13
L202	coil, horiz osc w/core	EP36X55
L301	coil quad w/core	EP36X83
L356	coil 47.25MHz trap	EP36X92
1C101	integ ckt, 1F, AGC	EP84X1
1C301	integ ckt, audio	EP84X2
1C303	integ ckt, AFC mod	EP84X3
1C501	integ ckt, demod	EP84X4
	fuse, 4a, fast blow, F401	EP10X52
	fuse, 5A, fast blow, F404	EP10X3
T204	HV xformer, w/air gap	EP77X11
T301	x-former, audio output	ET64X105
T401	x-former, filament	EP64X21
T500	x-former, chroma bandpass	EP61X14
T502	coil, 3.58 output xformer, w/core	EP36X84

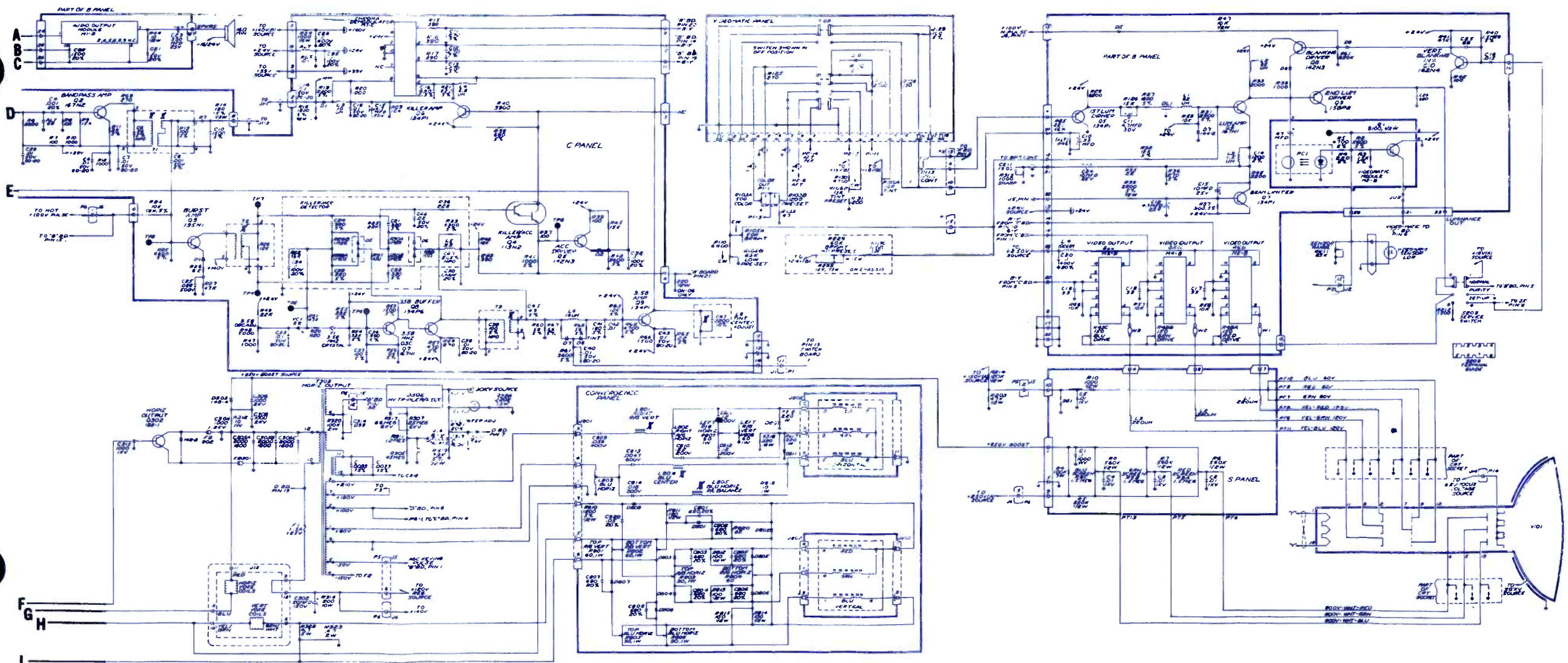
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 RESISTORS ARE 1/2 WATT  
 VOLTAGE MEASUREMENTS MADE WITH A VTVM WITH RESPECT TO CHASSIS. RECEIVER SET FOR NORMAL OPERATION. MEASUREMENTS MAY VARY ±10% AT 120V AC LINE VOLTAGE.  
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 VOLTAGES ON THE TERMINALS OF Q107, Q108, Q109, Q110 MAY VARY WITH PICTURE CONTENT AND BRIGHTNESS, CONTRAST AND BRIGHTNESS CENTERING CONTROL SETTINGS.  
 VOLTAGES ON THE TERMINALS OF Q600, Q604, Q606 AND THE CRT CONTROL GRIDS MAY VARY WITH PICTURE CONTENT AND BRIGHTNESS, CONTRAST, BRIGHTNESS CENTERING, AND COLOR CONTROL SETTINGS.



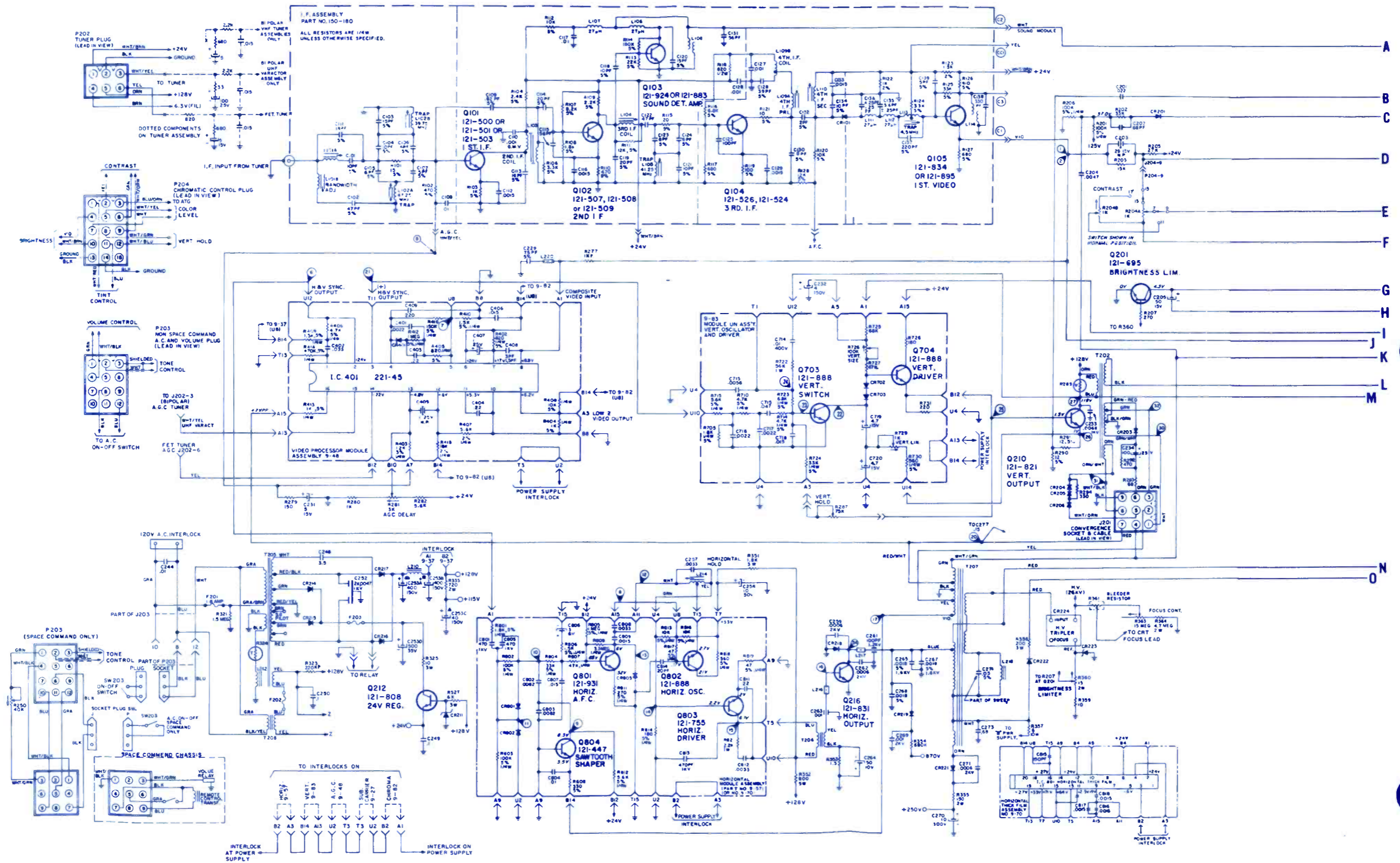




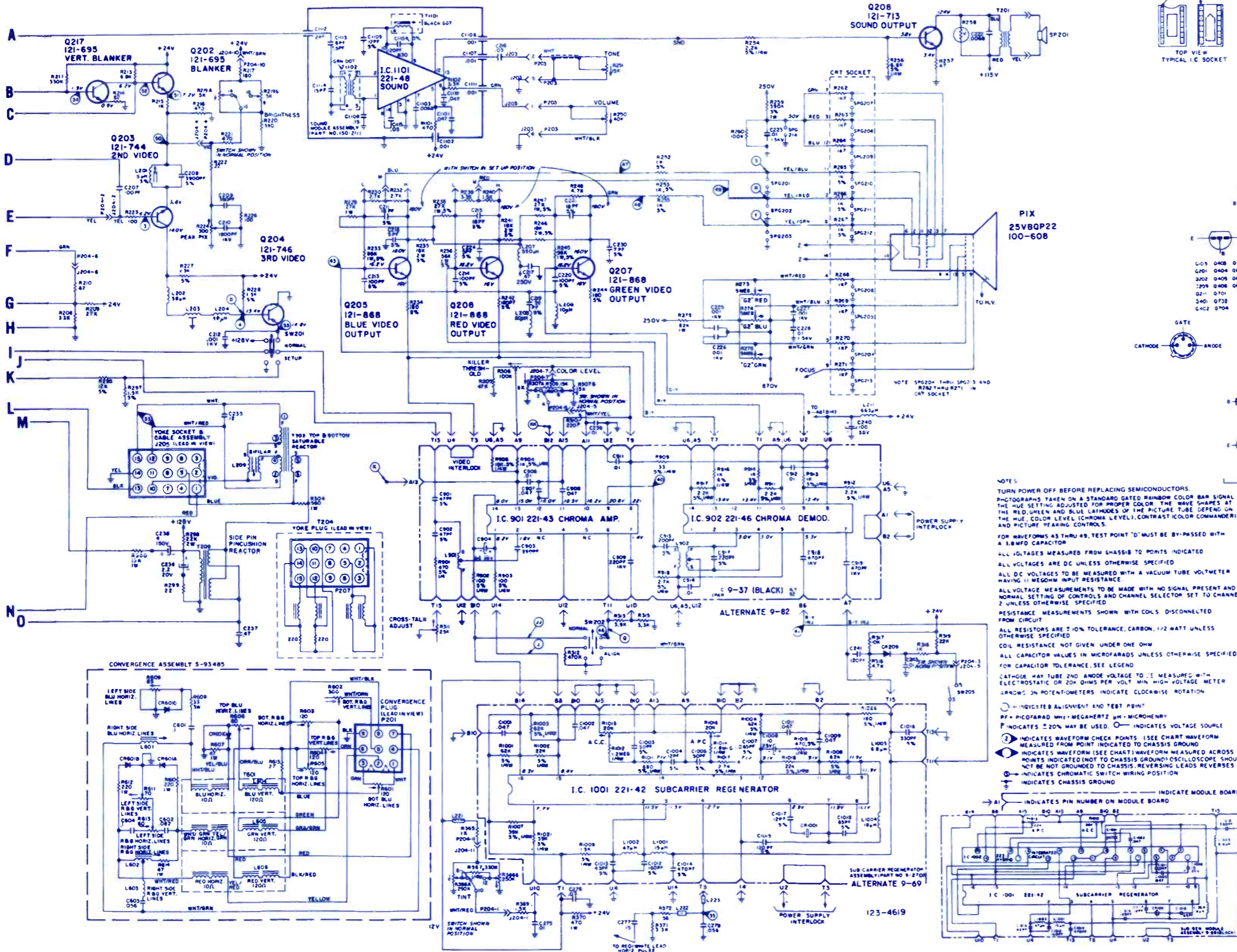
**MAGNAVOX**  
Color-TV Chassis T989





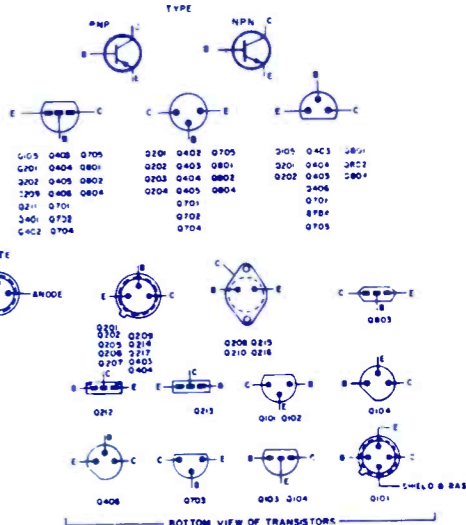
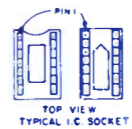






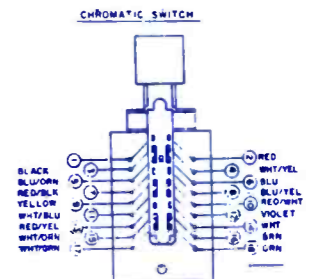
TEST POINTS

B	BY-PASS WITH 470PF DURING 4TH I.F. ALIGNMENT
C1	PICTURE DETECTOR OUTPUT
CC1	BIAS POINT FOR C1 ADJUST
C2	SOUND DETECTOR OUTPUT
D	BY-PASS WITH 10µF 25V ELECTROLYTIC DURING COLOR ALIGNMENT
E	I.F. A.G.C.
G	INPUT TEST POINT FOR 4TH I.F. ALIGNMENT
J	A.C.C.
K	TURN COLOR THRESHOLD CONTROL TO MAX CLOCKWISE POSITION TO OPEN COLOR CHANNEL
M	SOUND OUTPUT
Q	A.C.C. VOLTAGE
S	R-Y COLOR AMP PLATE
Y	G-Y COLOR AMP PLATE
W	B-WHITNESS LIMITER SET UP POINTS



NOTES

- TURN POWER OFF BEFORE REPLACING SEMICONDUCTORS.
- PHOTOGRAPHS TAKEN ON A STANDARD GATED RAINBOW COLOR BAR SIGNAL THE HUE SETTING ADJUSTED FOR PROPER COLOR. THE WAVE SHAPES AT THE RED, GREEN AND BLUE LATHODES OF THE PICTURE TUBE DEPEND ON THE HUE, COLOR LEVEL (CHROMA LEVEL), CONTRAST (COLOR COMMANDER) AND PICTURE TWEAKING CONTROLS.
- FOR WAVEFORMS A3 THRU A9, TEST POINT "D" MUST BE BY-PASSED WITH A 1.8MF CAPACITOR.
- ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED.
- ALL VOLTAGES ARE DC UNLESS OTHERWISE SPECIFIED.
- ALL DC VOLTAGES TO BE MEASURED WITH A VACUUM TUBE VOLTMETER HAVING 11 MEGOHM INPUT RESISTANCE.
- ALL VOLTAGE MEASUREMENTS TO BE MADE WITH NO SIGNAL PRESENT AND NORMAL SETTING OF CONTROLS AND CHANNEL SELECTOR SET TO CHANNEL 2 UNLESS OTHERWISE SPECIFIED.
- RESISTANCE MEASUREMENTS SHOWN WITH COILS DISCONNECTED FROM CIRCUIT.
- ALL RESISTORS ARE 20% TOLERANCE, CARBON, 1/2 WATT UNLESS OTHERWISE SPECIFIED.
- COIL RESISTANCE NOT GIVEN UNDER ONE OHM.
- ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED FOR CAPACITOR TOLERANCE, SEE LEGEND.
- CATHODE RAY TUBE 2ND ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC OR 20K OHMS PER VOLT MIN HIGH VOLTAGE METER.
- ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.
- ⊖ INDICATES ALIGNMENT AND TEST POINT.
- PF = PICOFARAD, MH = MEGAHERTZ, µH = MICROHENRY.
- ⊕ INDICATES 20% MAY BE USED.
- ⊖ INDICATES VOLTAGE SOURCE.
- ⊖ INDICATES WAVEFORM CHECK POINTS (SEE CHART WAVEFORM MEASURED FROM POINT INDICATED TO CHASSIS GROUND).
- ⊖ INDICATES WAVEFORM (SEE CHART) WAVEFORM MEASURED ACROSS POINTS INDICATED (NOT TO CHASSIS GROUND) OSCILLOSCOPE SHOULD NOT BE NOT GROUND TO CHASSIS. REVERSING LEADS REVERSES WAVEFORM.
- ⊖ INDICATES CHROMATIC SWITCH WIRING POSITION.
- ⊖ INDICATES CHASSIS GROUND.
- ⊖ INDICATES PIN NUMBER ON MODULE BOARD.

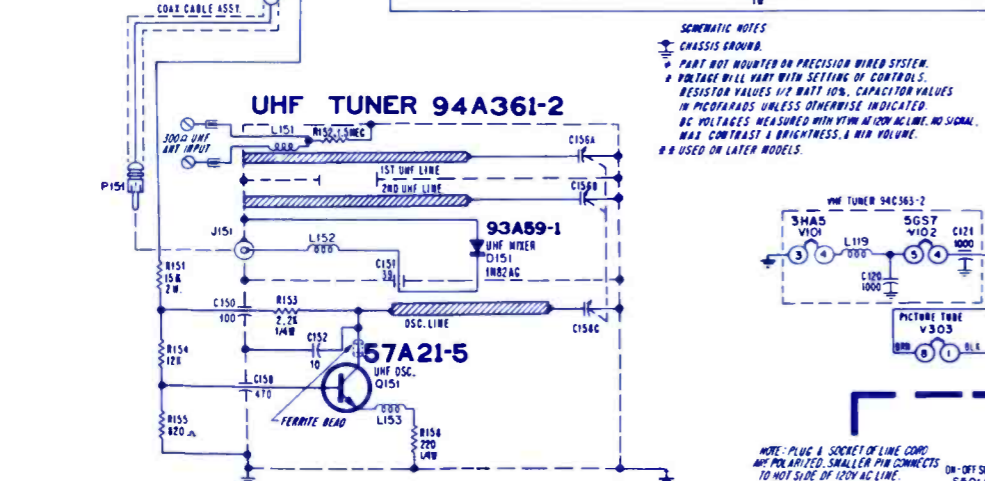
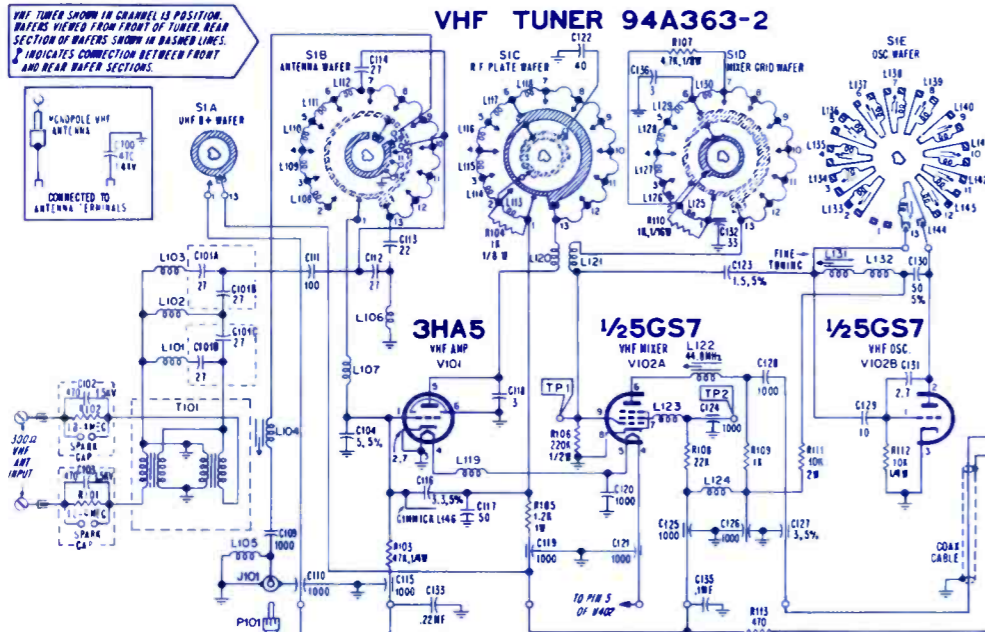
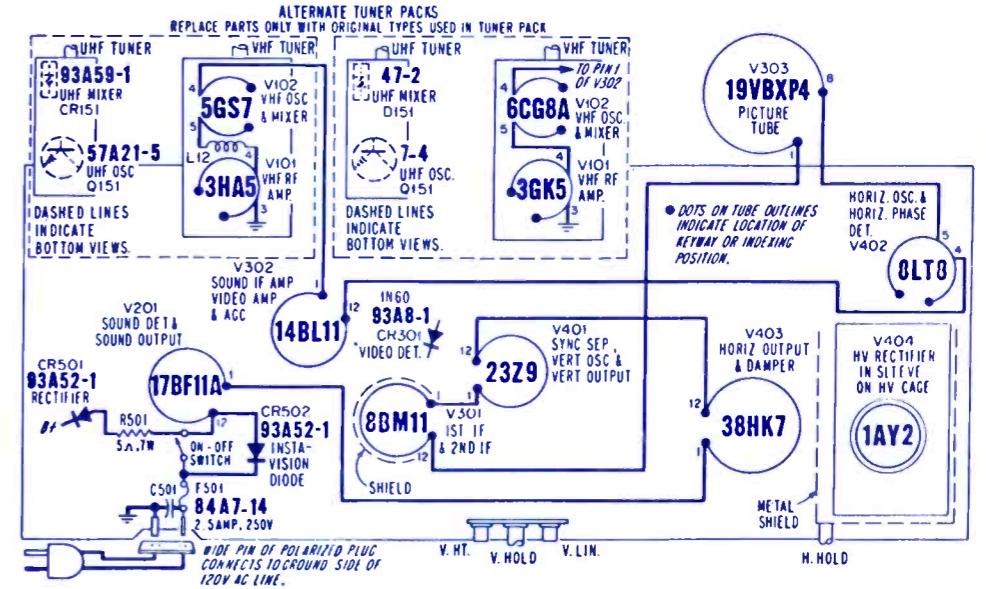


IMPORTANT SAFETY NOTICE

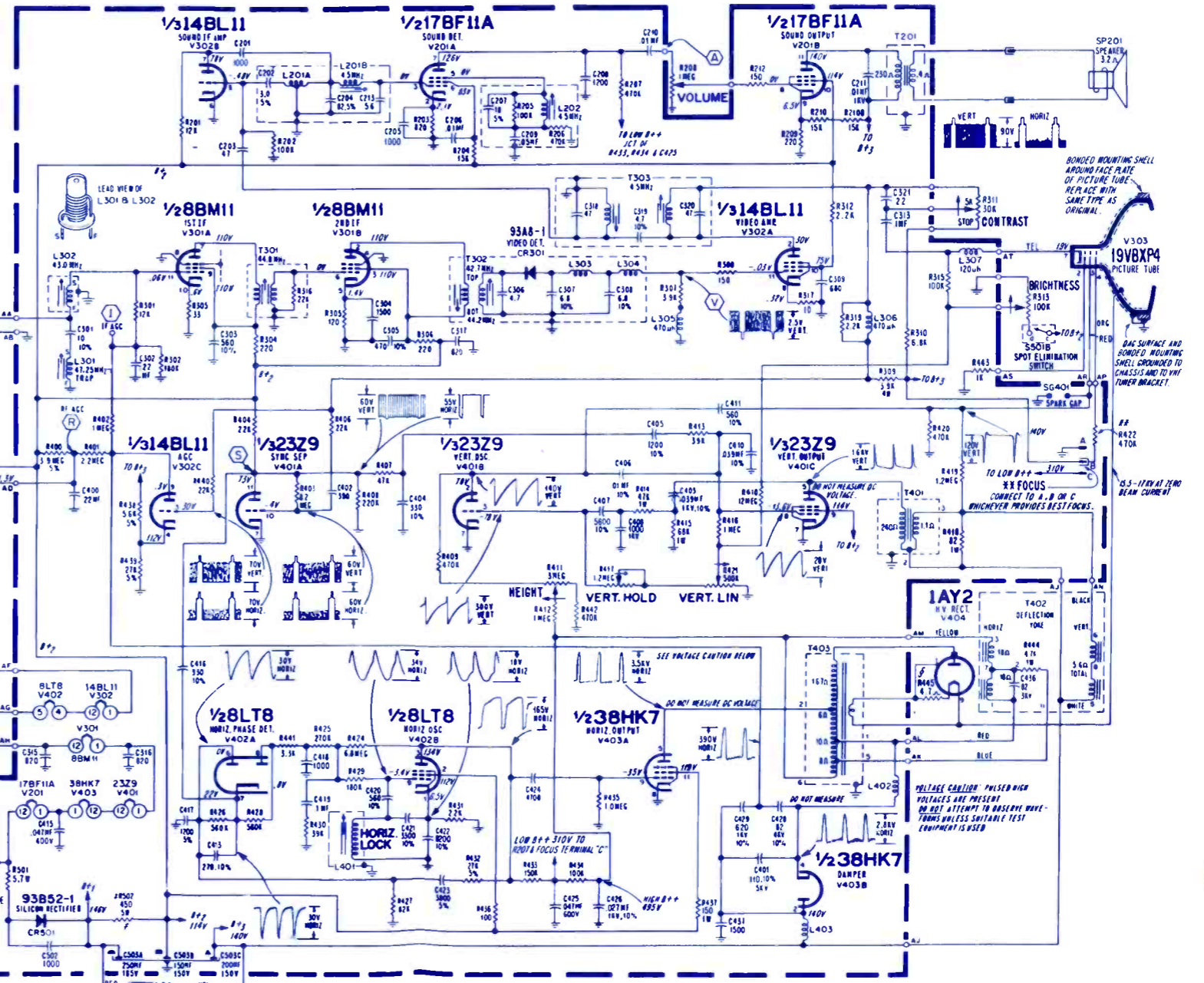
WHEN SERVICING THIS CHASSIS, UNDER NO CIRCUMSTANCES SHOULD THE ORIGINAL DESIGN BE MODIFIED OR ALTERED WITHOUT PERMISSION FROM THE ZENITH RADIO CORPORATION. ALL COMPONENTS SHOULD BE REPLACED ONLY WITH TYPES IDENTICAL TO THOSE IN THE ORIGINAL CIRCUIT. IN SOME INSTANCES REDUNDANT CIRCUITRY IS INCORPORATED FOR ADDITIONAL CIRCUIT PROTECTION AND X-RADIATION SAFETY AND MUST BE RETAINED ACCORDINGLY.



SYMBOL	DESCRIPTION	AIRLINE PART NO.
C503A, B	250 $\mu$ F/165V, 150 $\mu$ F/160V	67A30 11
C	200 $\mu$ F/150V electrolytic	75A149 10
R208	1M volume	75A112 13
R311	30K, contrast	75A129 3
R411	3M, height	75A129 3
R417	1.2M, vert hold	75A129 3
R421	500K, vert lin	75A129 3
L201A, B	coil, sound IF	72A301 4
L202	coil, quad	72A132 82
L401	coil, horiz osc lock	94A17 19
T201	x-former, audio output	79A124 3
T301	x-former, 1st IF, 44.8MHz	72A308 2
T302	x-former, 2nd IF, 42.7MHz inc C306	72A310 1
T401	x-former, vert output	79A139 5
T402	deflect yoke inc. C436 & R444	750A1089 12
T403	x-former, horiz output	79A138 22



**SAFETY NOTICE**  
THE DESIGN OF THIS RECEIVER CONTAINS MANY CIRCUITS AND COMPONENTS INCLUDED SPECIFICALLY FOR SAFETY PURPOSES. FOR CONTINUED PROTECTION, NO CHANGES SHOULD BE MADE TO THE ORIGINAL DESIGN. REPLACEMENT PARTS MUST BE IDENTICAL TO THOSE USED IN THE ORIGINAL CIRCUIT. SERVICE SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.



**SCHEMATIC NOTES**  
CHASSIS GROUND  
PART NOT MOUNTED ON PRECISION WIRED SYSTEM.  
VOLTAGE WILL VARY WITH SETTINGS OF CONTROLS.  
RESISTOR VALUES 1/2 WATT 10%. CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE INDICATED.  
DC VOLTAGES MEASURED WITH VTVM IN 200K AC LINE, NO SIGNAL, MAX. CONTRAST & BRIGHTNESS, & MIN VOLUME.  
R/R USED ON LATER MODELS.

NOTE: PLUG A SOCKET OF LINE CORD AND POLARIZED, SMALLER PIN CONNECTS TO NOT SIDE OF 120V AC LINE.



# Announcing the RCA MINI-STATE Antenna System



**The profitable new achievement in antenna technology.**

The Mini-State is brand new from RCA. It's the first true miniaturized rotating antenna system on the market. *It works . . . and works well!*

This system is specifically made for your metropolitan and suburban customers who want the quality reception of an outdoor-type antenna, in a beautifully compact unit suitable for homes and apartments.

Measuring just 21" across and 7" high, the Mini-State is completely enclosed in an attractive sturdy plastic case that's weatherproof and resistant to dust and dirt. It weighs just 6 pounds and can be mounted almost anywhere: rooftop, chimney, window, attic and closet.

The RCA Mini-State's uni-directional pattern, VHF slotted ring and multi-element UHF design, combined with its completely integrated solid state circuitry, provides excellent reception on all channels, and helps avoid interference and ghosts.

Mini-State model 5MS440, with built-in rotator, allows your customers to zero-in for best reception on any chan-

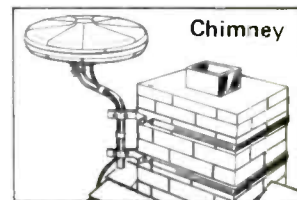
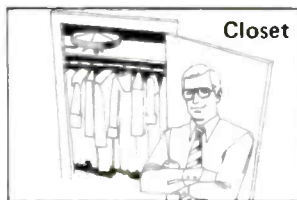
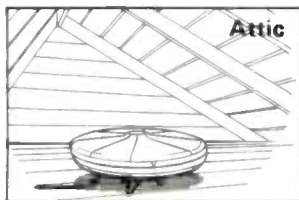
nel. Exclusive direction indicator light on the hand held control unit tells them where the antenna is aimed.

The RCA Mini-State rotating antenna system includes: The antenna with built-in amplifier. Built-in rotator and hand held remote control unit. A 120 volt AC power supply. A VHF-UHF antenna matching transformer. An outdoor mast clamp. Legs which can be snapped into place for indoor use.

Although regular coaxial and rotator cable may be used, a unique combined coaxial and rotator cable is available in prefabricated lengths for quick, easy installation. (A fixed non-rotating model 5MS330 is also available.)

Yes, this new RCA Mini-State antenna system can mean maxi-profits for you. See your RCA Parts and Accessories distributor today, or contact RCA Parts and Accessories, P.O. Box 100, Deptford, N.J. 08096. Make sure you're in on the ground floor of this profitable new era in TV antenna systems.

**RCA**



If your problem is **measuring  $\mu V$ ,**  
 **$\mu A$  and milliohms**  
 in transistorized  
 and integrated  
 circuits . . .  
 Solve it with  
**Triplet's 801**



Model **801**  
**\$ 231**

1. Lower power ohms — 8 ranges with 35 mV power source and 1 ohm center scale.
2. High sensitivity — 5 mV AC full scale at 10 megohm input impedance; 50 mV DC at 11 megohm input resistance.
3. Simplified scale — 8" meter with only 4 arcs for all 73 ranges.

It offers 73 measurement ranges including 8 low-power resistance ranges that apply only 35 mV to the device under test . . . does not activate or damage solid-state components. With full-scale readings as low as 50 mV DC and 5 mV AC, 5  $\mu A$  DC and 100 Ohms (1 Ohm center-scale) — plus a 10 megohm input impedance on the AC scales and 11 megohm input resistance on DC — Triplet's Model 801

V-O-M is ideally suited to in-circuit testing. When you add 2% DC and 3% AC accuracy on the voltage ranges (current: 3% DC and 4% AC) and a 25  $\mu A$  suspension-type meter with a nearly 7½" scale length, there's no doubt that the Model 801 has no equal among analog V-O-M's in terms of sensitivity and versatility. And there's an optional **Leakage Adapter (\$33)** that measures leakage currents

as low as 1  $\mu A$ .

See the remarkable **Model 801 V-O-M** — priced at **\$231** — at your Triplet distributor. For more information—or for a free demonstration—call him or your Triplet sales representative right away. Triplet Corporation, Bluffton, Ohio 45817.

**TRIPLET**

The World's most complete line of V-O-M's . . .  
 choose the one that's just right for you

For full details . . . . . Dial Toll-Free 800-645-9200 for nearest Triplet  
 Representative. . . . . New York State . . . . . Call Collect 516-294-0990

. . . for more details circle 138 on Reader Service Card